

FEB 1982

\$1.95 NZ \$2.50

**BUMPER**  
**Circuit Source Guide**

**eti**

**ELECTRONICS**  
**TODAY**  
**INTERNATIONAL**

**TANDY'S TRS 80**  
**COLOUR**  
**COMPUTER**  
**RELEASED**

**YAMAHA "X-POWER"**  
**B6 AMPLIFIER**  
**First Review**



**Build our**  
**SOUND BENDER**  
**for special voice:**  
**music effects**

**'Space Invaders'**  
**for our '660**  
**Computer**

**ZX81 Reviewed**







## The Sansui Midi System is Just My Style.

The Sansui Hi-Tech Compo series is the newest concept in personal entertainment from Sansui. And here's the first product from this series. The Sansui Midi System M7. We think it's just your style.

You want convenience. You get it. Both the Midi System's cassette deck and turntable give you pushbutton automatic selection of songs. Its tuner memorizes your favourite stations. And yet another handy feature lets you flawlessly and automatically dub songs in any order from your discs.

You want performance. You get it. The turntable is of the new linear-tracking variety for unexcelled accuracy. The tuner is designed to

never drift off frequency. And the cassette deck accepts all popular tapes—even metal.

You also want simple operation and renowned Sansui sound quality. You get both.

But two things you *don't* want are room-filling dimensions and a high price tag. Rest assured that these are definitely not part of the Sansui Hi-Tech concept.

See, touch and hear the Midi System M7 at your Sansui dealer today.

**Hi-Tech  
Compo**  
Compact, high-technology  
components for modern lifestyles



Midi System M7

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168 Japan  
VANFI (AUST.) PTY. LTD. 297 City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200  
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293







# ELECTRONICS TODAY INTERNATIONAL

Registered by Australia Post —  
Publication No. NBP0407  
ISSN No. 0013-5216



The laser show was so good  
I went back five times . . .  
it finishes, umm . . . hang on, I'm  
not too good on this Braille, yet.

Roger Harrison  
Editor

## QUICK INDEX

### FEATURES

- 8 Ten planets?
- 16 Circuit Source Guide
- 59 'Idea of the Month' Contest
- 146 Dregs

### PROJECTS & TECHNICAL

- 16 Circuit Source Guide
- 37 492: Sound Bender
- 44 723: 'Selectacall'
- 52 Short Ccts: Function Gen.
- 54 Ideas For Experimenters
- 62 Shoparound

### COMPUTING TODAY

- 71 Tandy's 'Color Computer'
- 74 Printout — News & Views
- 86 'Screenprint' — for  
Sorcerer/MX80 combo
- 91 ZX81 Review
- 101 Graphic Details
- 108 Pack More on Tape
- 111 Fox & Hen for the ZX80
- 116 '660 Software

### SIGHT & SOUND

- 19 The Year of the Turntable
- 120 Sight & Sound News
- 126 Yamaha B6 Amp Reviewed
- 138 Mordaunt-Short Pageant II  
Speakers Reviewed

### GENERAL

- 8 News Digest
- 34 Babani Books — Mail Order
- 65 Communications News
- 143 ETI Services & Credits
- 144 Mini-Mart — Readers' Adverts

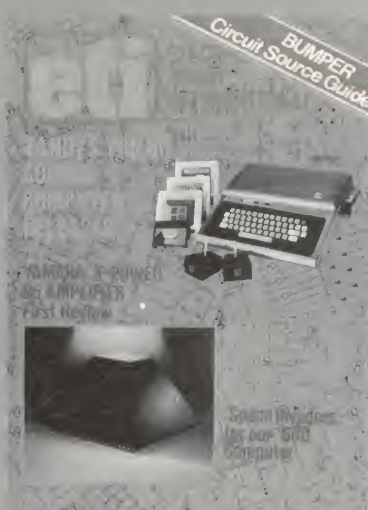


## advertisers

Australia Government	106-107, 114
Applied Technology	76-77
Altronics	14-15
Archive Computers	82
Adaptive Electronics	51
Acoustic Foundry	129
Alfatron	75
Arena	137
All Electronic Components	50
AED	72-73
Audio Engineers	135
A & R Soanar	32
Bishop Graphics	49
Bright Star Crystals	112
Best Vision	123
Boffin	115
COMDEC	70
Consolidated Marketing	32, 33
Cletronic	51
Computer Country	80, 92
Computerware	115
Coltronic	133
Computer City	112
Convoy	128, 133
Dick Smith	12, 28, 53, 55, 56, 60, 61, 66, 67, 84, 88, 100, 113
David Reid	48
Danish Hi-Fi	123
Electronic Development Sales	31
Electronic Agencies	36
Ellistronics	43
Elsema	51
Energy Control	115
Electrocraft	64
Emac	42
G.F.S.	64
Hagemeyer	OBC
Imark	64
ICS	81
Jaycar	41, 47, 58
Leisure Press Group	140-141
Looky Video	75
Mail Order Centre	42
Microgear	93
Magnetic Media	93
Micro80	79
Marantz	124
Mini Tool	98-99
Nutek	93
North Point Hi-fi	118
Overlander	145
Peterson	130
Power Chip Software	75
Printed Circuits Australia	10
Pre-Pak	68-69
Q.T. Computers	89
Raimar	121, 129
Rod Irving	63, 83, 90, 96, 110
Radio Despatch	42
Radio Parts	112
S.I. Microcomputers	118
Software Source	51
Sony	147
Tandy	105
Truscotts	52
TCT Micro	115
Vicom	11
Vanfi	IFC
Warburton Franki	85
Wheels	136

# eti

## ELECTRONICS TODAY INTERNATIONAL



This month's feature, Circuit Source Guide, provides an interesting montage backdrop to our 'preview' story of Tandy's Colour/Color Computer and our Review of Yamaha's B6 'X-Power' amplifier. Background colour is real silver!

Cover design by Ali White.

\*Recommended retail price only

## news

### NEWS DIGEST

Are there ten planets?; Fibre optics experiment in rural Canada; Newcastle Tech electronics courses; Batteries for toys and games; etc.

### COMMUNICATIONS NEWS

Russian 'robot birds' in orbit; 24-hour quartz world clock; Club call; etc.

### PRINTOUT

For Sorcerer apprentices; IBM wins West German videotext order; National software survey; Interfacing the PC-1211 to another computer; and lots more.

### SIGHT & SOUND NEWS

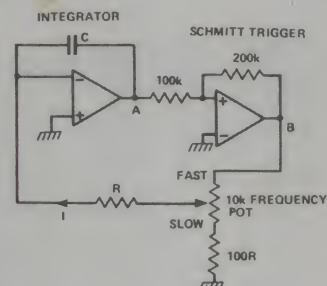
The All-Japan Audio Show; Video industry group formed; TV wristwatch not far away?; New range of Marantz gold cassette decks; Double cassette deck from Sharp; and much more.

## features

### CIRCUIT SOURCE GUIDE

16

An abundance of circuits giving a useful source from which you can derive other circuits or assemble a circuit from a variety of 'blocks' to suit a particular application. You may have seen some of them before, but there are bound to be some that are new to you.



## projects

### 492: SOUND BENDER

37

Based on a remarkably versatile function generator IC, the XR2206, this project is capable of modifying an audio signal to produce tremolo effects on music or those peculiar, metallic robot voices so abundantly found in shows like 'Star Wars', 'Star Trek', 'Dr Who', etc.



### 723: SELECTACALL ADD-ON FOR HAM/CB TRANSCEIVERS

44

If you're listening on a channel for some particular station to call, but don't want to listen to the background chatter, then this simple accessory holds the mute shut until that 'certain party' calls — no tones or funny noises required.





# computing

## COMPUTING TODAY

Tandy's new TRS80 with colour — it's here!

70



## SCREENPRINT FOR SORCERER/MX80

86

This is a method of getting the Sorcerer to print what it's showing on the screen onto an attached Epson MX80 printer.

## SINCLAIR'S LITTLE BEAUTY — THE ZX81

91

The ZX81 is a remarkable machine for many reasons, not least of which is its low price. We asked Phil Cohen to review it for us.

## GRAPHIC DETAILS

101

This article gives details of how you can translate a program written for one machine using a particular graphics set into a form usable for another machine with a different set. Includes the TRS80 and the PET.

6	214	X	246	1
7	215	0	247	2
8	216	+	248	3
9	217	-	249	4
+	218	*	250	5
-	219	^	251	6
*	220	~	252	7
~	221	□	253	8
□	222	△	254	9
△	223	▽	255	0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6
*		~		7
~		□		8
□		△		9
△		▽		0
▽		◇		1
◇		○		2
○		×		3
×		+		4
+		-		5
-		*		6



# DIRECT IMPORT

# NEW ZEALANDERS

## TAKE ADVANTAGE OF DICK'S LOW PRICES

**DIRECT  
IMPORT**



### INCREDIBLE SYSTEM 80

We're proud to offer this exceptional computer to our New Zealand customers. These are just some of the features: 16K memory, S-100 expandable, compatible with almost all level II programs, works with any standard TV set, has built-in cassette deck level control. Quite simply it represents outstanding value for money.

SNZ

ONLY \$**1195**

X-4005 P&P \$5.50

### "Basic Introduction To System 80 Computer"

How to load and run pre-recorded programs, full explanation of BASIC error messages. Ideal for beginners.

Cat B-6200 ..... \$11.95nz  
P & P \$2.00

### CAR CLOCK

Unbelievably low priced car clock with easy to see digits and alarm. Runs on 12 volt D.C.

A great buy at this price.

Cat Y-1047

ONLY SNZ

\$**32<sup>50</sup>**

P & P \$3.00



**DIRECT  
IMPORT**

### DICK SMITH'S PRO QUALITY MULTIMETER

CHECKS TRANSISTORS &  
MEASURES CAPACITANCE 1000  
100k OHMS PER VOLT

This is virtually a complete test bench in one small package ... the features are too numerous to mention in such a small space. Comes complete with batteries, leads & instruction manual. Cat. Q-1140

ONLY \$**79**

P & P \$4.00

SNZ



### Top Value Headphones

Great for those who have a small bank account but still require a decent pair of headphones. Top quality sound, ideal also for schools etc. 80 ohms, 20-20,000Hz. Cat C-4101.

ONLY SNZ

\$**12<sup>50</sup>**

P & P \$2.00



**DIRECT  
IMPORT**

### Travellers Students & Politicians

### CRAIG LANGUAGE TRANSLATOR

We've made a huge scoop purchase of these units at way below the manufacturers cost! Translates into English or the reverse. Cat Y-1340

SNZ

ONLY \$**99**

P & P \$4.00



Great range of modules available:  
FRENCH (Y-1341) ..... \$18.50  
JAPANESE (Y-1342) ..... \$18.50  
GERMAN (Y-1343) ..... \$18.50  
ITALIAN (Y-1344) ..... \$18.50  
Bar & Wine Guide (Y-1345) ..... \$18.50  
Calorie Counter (Y-1346) \$18.50

P & P \$2.00 ea

### NEW WRIST SIZE SPACE ATTACKERS GAME

At a glance you can tell the time, BUT at the touch of a button it becomes an exciting space game.

This could well be the smallest Space Attackers game on Earth. You'll have light years of fun and entertainment wherever you go. Cat. Y-1154

HURRY, THEY'RE SELLING FAST!

NOW ONLY \$**89<sup>50</sup>**

P & P \$4.00 SNZ

**DIRECT  
IMPORT**

### DUAL TIME CHRONO WATCH

A great bargain that will be hard to pass up.

Look what you get for such a small price: dual time, melody alarm,

lap times, LCD display, and bracelet. So why pay the earth for features you'd expect to pay \$\$\$ more?

They're going to go fast at this price!

Cat Y 1044

\$NZ NOW  
\$**39<sup>50</sup>**

P & P \$3.00



### SAVE \$4.40 ON QUALITY TRANSISTORS

MJ15003 (Cat. No. Z-1808) & MJ15004 (Cat. No. Z-1810) are used in 300 watt module amps. They are extremely rugged rated 200 watts.

Were \$9.90 \$NZ \$5.50 ea  
P & P \$1.00

### INTERNATIONAL TRANSISTOR SELECTOR

Towers - 128 Pages. Top selling book, complete listing of over 10,000 transistors with substitutes, outline diagrams, terminal identification, manufacturers codes and specifications. Cat B-1825.

\$NZ \$12.50  
P & P \$2.00

DSE/A161/PA1

# DICK SMITH ELECTRONICS

98 Carlton Gore Rd. Newmarket  
Auckland 1. Ph. (Auckland) 50 4408 50 4409

MAIL ORDER CENTRE: Address as above.

STORE HOURS: Monday to Friday 8.30am to 5pm.

Call into our store and  
collect your copy of  
our catalogue!





# SONICS

The Australian music magazine dedicated to the art and craft of sound

YEARBOOK 1982

\*\$5.95

KRAFTWERK

humanistic technology

THE MICROSYSTEM

a revolution in lighting

ROCK ACOUSTICS

Stephen Court explains

1982 YEARBOOK  
out now  
all newsagents

RECORDING

-how to cope

...y makes  
...es as well as  
...d by radio, TV  
...out the world.  
... annually in  
...al information on  
...ups.  
...e most popular for  
...und work. They are  
...LR 3-pin connectors.  
...es Tax is 15% where

#### IES:

...dioid vocal/instrument mic for  
...d, suit drums/instruments. \$253  
...id mic for GP & home recording  
...Z cardioid mic specifically designed  
... use. \$295  
...s-cardioid PA mic for use in noisy  
...s; EQ'd for close speaking. \$231  
...ynamic directional for amateur.  
...ynamic Directional Microphone for studio.  
...Lo-Z omni-directional GP studio mic. \$157  
...1: Lo-Z omni-directional mic designed for close  
...g. \$277

#### INDISPENSABLE REFERENCE

Complete listings of virtually every instrument and piece of equipment designed for the electric musician or sound engineer; what it is, where to get it, what it will cost.

#### EDIFYING READING

Features, departments, reviews to keep you up-to-date, stimulated and informed.

#### TRY YOUR LUCK

Win a Yamaha SB200 System Board plus your choice of ten or eleven foot pedal effects. The efficient way to use pedal effects for your guitar.

mic, also used for  
work. \$540



## Come in, Planet X

Brace your tripods: the solar system may have ten planets, not nine.

**No one has actually seen this new planet, nor are astronomers certain it exists, but recent computer studies and planetary observations by the US Naval Observatory have sparked renewed interest in the theory that yet another celestial object — too faint to be seen with the naked eye — is circling the sun.**

So far the observatory's 'search' has been conducted largely with an IBM 4341 processor, a computer which is routinely fed a rich diet of astronomical data to plot past, present and future locations of the planets for navigational and other uses.

Soon the observatory plans to expand its efforts from the computer room to the night sky to track down this mysterious orb, explains Kenneth Seidelmann, director of the observatory's Nautical

Almanac Office.

If astronomers should find something, it would mark the first discovery of a major planet since Clyde Tombaugh of the Lowell Observatory discovered Pluto in 1930.

The big question is: where to look? The observatory feels a detailed survey of the entire sky would be too time consuming and expensive, but identifying a target zone is easier said than done. Even if the object does exist, it could be anything from a massive planet far beyond distant Pluto to a 'minor planet' sandwiched between the orbits of Pluto and Neptune.

The only way to fix a search target area is to make some educated guesses. So the computer was asked to assume that the object lay beyond Pluto, that its orbit was tilted from the plane of most other planets, and that its path

around the sun was very elliptical.

The IBM 4341 absorbed these assumptions, matched them against a crushing weight of astronomical data, and gave the scientists a list of possible places to start looking.

Scientists invoked the tenth planet to account for the curious wanderings of outer planets, such as Uranus and Neptune, from their predicted orbital paths. Pluto, the most distant known planet, was originally believed to be the culprit, but calculations based on recent observations of Pluto and its moon indicate that the tiny planet is simply too 'light' to have much of an impact on Uranus and Neptune.

Seidelmann is careful to point out that it is still possible the strange behaviour of the outer planets has nothing



Kenneth Seidelmann, director of the US Naval Observatory's Nautical Almanac Office, examines a chart showing differences between computer-predicted positions and the actual observations of Uranus, one of the solar system's outer planets.

to do with a tenth planet — telescopes may have failed to pinpoint their locations with sufficient accuracy, for instance. But if he were a gambler, he says, "I would bet there is probably something out there."

IBM Quarterly, Sept.'81

## Remote meter reading

**Britain's Department of Industry is supporting research into using the public electricity mains supply as a two-way information carrier for meter reading and energy management in the home. The project, known as 'Mainsborne Signalling System', will be carried out by Thorn-EMI in conjunction with the Electricity Council, the British Gas Corporation and the National Water Council.**

The potential benefits of such a signalling system include the remote reading of meters, the better control of energy, the detection of gas and water leaks, detection of fraud and vandalism of equipment, together with more detailed account information for customers.

Following the initial research, field trials will be carried out in about 1000 homes in the London and Milton Keynes areas involving the electricity, gas and water undertakings and the housing associations. Installations of the equipment into homes will commence early in 1982 and the trial itself will commence in the northern autumn of 1982.

During the trial period, the new system will not replace the reading of electricity or gas meters. They will continue to be read in the normal way by visiting meter readers for billing purposes.

Somewhat similar systems to this 'Mainsborne' system are being developed by the public and private sections of British Industry, but are based on the telephone network, long wave radio or cable vision systems to convey the information.

Discussions are taking place on the requirements of a compatible system so that UK Industry can take advantage of the considerable export opportunities.

Brian Dance

## Zephyr Products in Queensland

**Macron Electronics Pty Ltd, trading as Zephyr Products, have opened an office in Queensland at 3291 Pacific Highway, Underwood Qld. 4119. (07)341-3619.**

Mr. Danny Cousins has been appointed Northern Area Manager for the Company, which distributes RCF professional loudspeakers, horns and drivers, Perreux power MOSFET amplifiers, Primo microphones, Zephyr microphone stands, accessories, cables, components, Telecom-approved line isolation units,

PAs, hazardous voltage opto-isolator units, L.M. Ericsson and Dyne Telecom-approved transformers, SECO night viewing devices and optical products, Elfa guitar amplifiers, Helpenstill electric pianos and music accessories.

The company also undertakes electronic assembly work of all types.

### ERRATA

**Project 685, 2650 S100 Computer; December '81.** In the parts list, the power supply input bypass tantalum capacitors were erroneously specified as 6 V types. They should be 35 V types — these are capacitors C2, C4 and C5. Also, capacitors C1 and C9 may be 6 V or 10 V tantalums, but capacitors C6 and C7 should be 15 V or 25 V types.

**ETI-660 Learner's Micro, Nov. '81.** In the circuit diagram on page 37 the data buss lines adjacent to pins 26 to 33 of IC5 are shown in reverse order. D0 goes to pin 26, D7 to pin 33. This reverses the data out signals from the 6821, but it's all taken care of, so do not worry, my little chickens. Note that on page 39, the circuit shows the 1864 as IC3 when we all know damn well that it's actually IC4.





## Specialised pcb tools

Scope Laboratories have a new range of specialised hand tools with a scissor-type cutting action, known as Scope Flushcutters and consisting of four flushcutting sidecutters and a set of long-nosed pliers.

The manufacturers claim that this new blade design produces benefits both for the OEM production engineer and the service technician:

- Fatigue reduction — wires are sheared not crush cut.
- Tool life is extended due to high-hardness blades (super-durable model due in November 1981).
- Safety offcut catcher — protects operator's eyes and avoids product damage from

offcuts flying into equipment.

- Cuts superfine wires even at extreme blade tip.
- Gets into tight spots — e.g. can even cut single DIP pins in a pc board.
- Self-opening, allowing the user to concentrate on gripping.

For further information contact Bev Evans, Scope Laboratories, 3 Walton St, Airport West Vic. 3042. (03)338-1566.

## Batteries for toys and games

A completely new range of dry batteries designed specifically for use in toys, models and games has been launched by the Vidor Batteries division of Crompton Parkinson Limited, a Hawker Siddeley company.

Called the Vidor 'T' range, the new batteries have been produced to provide optimum performance and power for the rapidly increasing variety of motorised toys, cable and remote-controlled models and electronic games now in common use. The batteries employ a specially-formulated zinc-carbon Leclanche system designed to maximise the power available for this type of application. All batteries in the 'T' range have a leak-resistant steel jacket.

Vidor provide a written guarantee offering to repair or replace any toy, model or

game damaged by using a 'T' range battery defective in design, materials or workmanship, so confident are they of the quality of this range.

Vidor 'T' range batteries are available in the four most popular sizes for toys and games and comprise the T2, T11 and T7 round cell types and the PP3T type.

For further information contact Mark Whitfield, Hawker Siddeley Group Ltd, 32 Duke Street, St James's, London SW1Y 6DG, England.

## Lighting controller for all effects

Alfa Lighting claim to have produced a 'light controller in a class of its own... ideally suited for virtually any application required for an effect'.

The controller is built for ruggedness, dependability and superb performance, and among its many features are:

- master dim control
- forward/reverse
- auto bounce
- colour organ
- sound to light
- sound synchronisation
- superimposing/mixing of all patterns
- 1000 watts per channel
- all outputs fused
- master fuse

- variable dimming rate
- infinite audio-in capacity
- and lots more!

The chaser controls strobes, snakelights, projectors, mirror-ball motors, dance floors, signs, displays, pinspots/hotspots, light screens, all resistive loads and all inductive loads. Options are available.

For further information contact Alfa Lighting Pty Ltd, 4 Weldon St, Burwood NSW 2134. (02)74-8905.



## Slimline calculators for science and finance

Two new programmable calculators from Hewlett Packard, one scientific and one for financial and business problems, come in a 'slimline' design that fits in a shirt pocket.

Both feature liquid crystal display, continuous memory, a horizontal keyboard design and many built-in keyboard functions and programming tools.

The HP-11C scientific calculator features powerful programming tools and a full set of scientific functions, while the HP-12C financial calculator has a large number of built-in keyboard functions for solving time-value-of-money problems.

The HP-11C and HP-12C are also the first HP calculators to use easily available, disposable button-cell batteries, which cost under \$2 each. Because the

liquid crystal display and CMOS (complementary metal-oxide semiconductor) circuitry mean low power consumption, the calculators should run on one set of batteries for about one year.

Recommended tax-free price for the HP-11C is \$160; tax inclusive would be \$180.50. For the HP-12C the recommended prices are \$178 tax-free, \$201 tax included.

For more information contact Marcom Manager, Hewlett Packard Australia Pty Ltd, P.O. Box 36, Doncaster Vic. 3109.



## Rural fibre optics experiment

Canada recently started a unique experiment in communications technology by installing a fibre optics system to deliver a full range of communications services to the farming communities of Elie and St. Eustache, Manitoba, some 50 kilometres west of Winnipeg.

The C\$9 600 000 field trial will bring single-party digital telephone, cable TV, stereo FM radio and Telidon services to 150 households by means of hair-thin strands of glass called optical fibres. A rural setting was chosen for the project because telecommunications specialists believe fibre optics may provide the solution to the challenge of providing first-class communications over vast, sparsely populated rural areas.

Until now, many residents of the communities had only multi-party telephone services and received TV signals weakly by means of rooftop antennas. The fibre optics system will provide communications services comparable to those in urban environments, including nine TV channels and seven

radio stations. Residents will test the fibre optics system for 1½ years.

The fibre optics system uses glass fibres in place of conventional copper cables, electronic signals being carried in the form of pulses of light. Sophisticated electronic equipment converts conventional electrical signals into light pulses at one end, then back into electrical signals at the other end.

The field trial will determine the feasibility of using fibre optics to deliver multiple communications services in rural or sparsely populated areas. One glass fibre has the capability of simultaneous voice, data and video transmission in volumes and over distances far in excess of copper-based counterparts.

## Terminal blocks from Utilux

**New from Utilux is a complete range of high precision (screw) terminal blocks for printed circuit board mounting.**

Designated series H1700, these terminal blocks are available in three basic styles with terminal spacings of 5 mm and 10 mm; phosphor bronze wire protector springs are also available in all assembly styles.

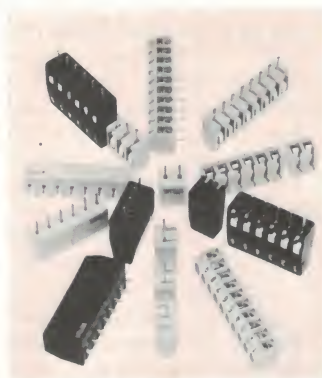
Whilst available circuit sizes differ in each assembly style, it is possible to obtain any circuit

size required by 'butting' two terminal blocks end-on without variation in terminal spacing.

These terminal blocks are said to be inexpensive and versatile and to answer the need for fast, efficient termination of conductors to printed circuit boards.

**FOR EVERY  
PRINTED  
CIRCUIT  
(EVER PUBLISHED)  
IN  
ETI  
PRINTED CIRCUITS  
AUSTRALIA**

651 Forest Rd., Bexley 2207  
Phone (02) 587-5385



For further details contact Utilux Pty Ltd, 14 Commercial Road, Kingsgrove NSW 2208. (02)50-0155; telex: 21516.



## Paper-thin batteries for slimline electronics

**Matsushita Battery Industrial Co Ltd have developed a paper-thin sheet-type lithium battery measuring only 1.3 mm thick, yet said to feature an energy density as much as ten times higher than that of manganese dry batteries.**

The new battery uses lithium in its negative electrode and carbon monofluoride as the positive electrode. Nominal voltage is 3 V, double the voltage of ordinary batteries, and the temperature characteristics are said to provide high performance even at low temperatures. The energy density is claimed to be high enough to drive electric motors.

The paper-thin lithium

battery comes in three sizes, and should find applications in LCD electronic calculators, digital watches, cameras, radios, compact tape recorders, pocket pagers, memory back-up systems and other miniature electronics products, particularly those which have to operate at low temperatures.

For further information contact Michelle Myers on (02)887-0144, Ext. 266.

## Newcastle Tech courses

**Newcastle Technical College will be offering several trades, post-trades and special courses in 1982.**

The Electronics Trades course is of three years' duration and covers all aspects of analogue and digital techniques. Attendance may be either one day a week, two nights per week, or block release for country students (three days every third week).

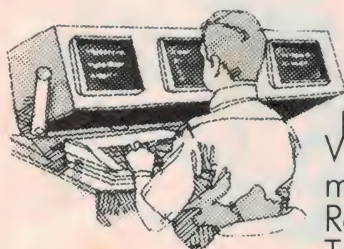
Post-trades courses include Television Receiver Principles, Industrial Electronics, Semiconductor Electronics and Post-Trade Electronics. The College will also run special courses in Microprocessor

Evaluation, Microprocessor Circuits and Applications, Film and Television Production for Education and Industry, Technical Principles of Two-way Radio, and a Two-way Radio Users' Course.

All enquiries should be directed to the Senior Head Teacher, School of Electronics, Newcastle Technical College, Maitland Rd, Tighes Hill NSW 2290. The College will be open for enquiries and enrolments from Monday, February 1 1982.



# Hear and Now.



It may come as a surprise to some people to learn that Vicom are involved in more than Amateur Radio.

True, Vicom was founded by three of the best-known Amateur Radio operators in Australia.

But, like most good businessmen, they expanded their business to encompass the professional side of electronics and radio.

After all, the intricacies of today's advanced electronic technology apply as much to radar, avionics, marine and mining as they do to the smallest hand-held receiver.

In the Broadcast and Television Industry we supply the Government and private industry with Hirschmann Transponders and Test Equipment, Radio Signal Meters, TV Signal Meters and Group Delay Meters.

In the Avionics Industry we are the sole suppliers of avionic test equipment in Australia representing world-renowned IFR products.

In the Marine Industry we supply the high quality and highly sophisticated Dansk ship-board radio, radar and direction finding equipment among other brands.

In the Television and Mining Industries we will be supplying Microdyne Satellite



Receivers, suitable for the new Australian satellite due to come into operation in 1985. We also supply the West German made UKW satellite receivers

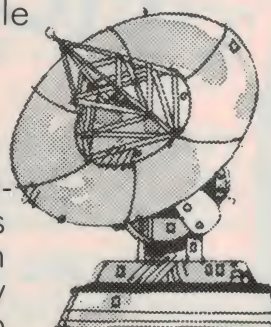
for receiving weather information.

In the Mining Industry – or any high security industry – we supply Datotek Digital Voice Encryption equipment to ensure total security on any communication – radio, telex, telephone or facsimile.

Vicom is also the major supplier of top quality communication service monitors and assorted test equipment. In particular, the IFR portable

Communication Service Monitor for testing two-way radio faults.

Whether Professional or Amateur electronic communications, Vicom is bringing the very latest in advanced technology from around the world to meet Australian electronic needs.



And to match the best in equipment, the most



highly trained technicians to ensure the best possible back-up.



**VICOM**  
People to People.

BURROWS DOBLE LAWRENCE VIC/084/ET1



# TWICE THE FUN!

## WITH DICK SMITH FUN WAY INTO ELECTRONICS

**Vol 1** For the absolute beginner, this book is a must. 20 exciting projects - all built without the need to solder. The unique "breadboard" method of construction enables you to follow the circuit via the wires, and because every project is battery powered, they are perfectly safe! Learn electronics the FUN WAY! Cat. B-2600

**Vol 2** We now have this superb book in stock again. Packed with 20 exciting projects to build (see Kit list below) this book provides fun AND education! From printed circuit boards to using a multimeter, it's all there - and it's fun. Cat. B-2605

**\$4<sup>95</sup>**

**\$6<sup>95</sup>**

POST AND PACKAGE  
\$1 PER BOOK

# TWICE THE VALUE!

## BOOKS & KIT PACKS

### FUN WAY VOL. 1 VALUE PACK

An easy to follow system of learning basic electronics. 20 exciting projects for you to build ranging from a beer powered radio to an electronic siren. Completely safe, no need to solder, suitable for all ages. Hours of fun building educational projects. Find out what electronics is all about - the easy way! Cat. K-2615

ONLY  
**\$17<sup>95</sup>**

### FUN WAY VOL. 2 GIFT PACK WITH SOLDERING IRON

Fantastic savings! Over \$25 value! Everything you need to build an actual working project, including a hobbyist soldering iron and pack of solder, a 9 volt battery, a copy of 'Fun Way Vol. 2' and a Wireless Microphone Kit. The 'Fun Way Vol. 2 Gift Pack' makes electronics fun, easy, and now, economical. Cat K-2620

ALL FOR  
**\$19<sup>95</sup>**

## FUN WAY TWO KITS: EASY, SAFE & ECONOMICAL!

### MULTI-PURPOSE LED FLASHER . . . . . \$2.75

A really simple kit that can be used as a warning device, electronic jewellery, etc. Cat K-2621

### DING DONG DOORBELL . . . . . \$4.00

Welcome visitors to your home with this integrated circuit doorbell! Cat K-2622

### MORSE CODE TRAINER . . . . . \$4.00

This simple oscillator circuit lets you learn Morse code the easy way! Cat K-2623.

### UNIVERSAL TIMER . . . . . \$5.00

Use it as an egg timer, a dark-room timer, etc: in fact, it's got a lot of applications! Cat K-2624

### ELECTRONIC DICE . . . . . \$4.75

Throwing a dice is old hat: do it electronically! Simple circuit has other uses too. Cat K-2625

### MONOPHONIC ORGAN . . . . . \$7.50

Easy to build, and easy to play! And it even has 'vibrato' - just like the big ones! Cat K-2626

### POCKET TRANSISTOR RADIO . . . . . \$7.50

Simple to build, and it's nice and small. Listening is so much more fun! Cat K-2627

### TOUCH SWITCH . . . . . \$4.90

One touch on, next touch off - or 'on while touched'. Dozens of uses in the home. Cat K-2628

### MOSQUITO REPELLER . . . . . \$4.50

Don't get eaten by mozzies: scare them away electronically. Take it anywhere. Cat K-2629

### SIMPLE AMPLIFIER . . . . . \$6.00

A useful little amplifier for all those projects needing audio amplification. Cat K-2630

### WIRELESS MIC. . . . . \$6.50

A tiny transmitter that can be received on any FM receiver. A great little kit! Cat K-2631

### LIGHT ACTIVATED SWITCH . . . . . \$4.90

Highly useful for alarms, night light switches, etc etc. Sensitive and reliable. Cat K-2632

### METAL/PIPE LOCATOR . . . . . \$6.00

A simple BFO circuit you can use to find metals, pipes, wiring, etc - maybe gold! Cat K-2633

### SOUND ACTIVATED SWITCH . . . . . \$6.50

Picks up sound waves and trips a relay. Use as a telephone bell extender, too. Cat K-2634

### HOME/CAR BURGLAR ALARM . . . . . \$6.00

Learn how burglar alarms work when you install your own! For home or car. Cat K-2635

### ELECTRONIC SIREN . . . . . \$4.50

Great for alarm use - or where any warning is required. Good for kids toys, too! Cat K-2636

### LED LEVEL DISPLAY . . . . . \$8.50

This fascinating project shows you the audio level of any amplifier. Cat K-2637

### INTERCOM UNIT . . . . . \$8.50

Communicate! Build this intercom and talk between rooms, etc. Cat K-2638

### LED COUNTER MODULE . . . . . \$7.50

Learn how digital circuits work by building a counter. Count slot car laps, etc. Cat K-2639

### SHORTWAVE RECEIVER . . . . . \$6.50

Listen in to the exciting world of shortwave radio: amateurs, foreign countries! Cat K-2640

**SCHOOLS, RE-SELLERS ETC:**  
Ask about our incredible discounts for bulk quantities on either books or kits or both!

# DICK SMITH ELECTRONICS

See our other advertisements for address details





**GET  
INTO  
IT!**



Computers and computing is the latest 'boom' area in hobby electronics, or any hobby pursuit for that matter. That's why we've called our latest book 'Computers & Computing — Yearbook 1982'. Assembled from articles published in Electronics Today International over the past two years, this book carries on from our previous, 1980, Yearbook. That book was one of the most successful we've ever published! The 1982 Yearbook is resplendent with all-new text, including some articles not previously published in ETI. The text is divided between software and hardware and includes popular series like 'Back Door Into BASIC' and projects like the ETI-681 S100 Programmable Character Generator and the ETI-660 Learner's Microcomputer. There are equipment reviews, covering the Tandy and Sharp handhelds, the Apple II and System 80 as well as the Anadex DP-9500 printer etc. There are articles on modifying TVs for video display and modifying cassette recorders for reliable operation, too. There are programs for sorting, programs for POKEing and programs for plotting. There are programs for Sorcerers, System 80s, TRS-80s and 2650s — and let's not forget the PET.

## **148 JAM-PACKED PAGES FOR A PICAYUNE \$4.95\*!**

\*plus 90 cents post and handling.

If you are/want-to-get into computers and computing, then ETI's Computers & Computing Yearbook 1982 is what you need to get.

Just parcel up \$4.95 in rust-proof coinage, a stainless-steel cheque or a money order backed by the government of the day (made out to ETI/Murray Publishers), not forgetting to add 90 cents for post and handling which brings the grand total to a puny \$5.85. Send it to us at: ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.

**ON SALE AT NEWSAGENTS AND SELECTED ELECTRONICS SUPPLIERS.**



# ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS



BANKCARD JETSERVICE-DELIVERY NEXT DAY

# Will the other 48,000 Electronic enthusiasts now stand up !!!

E.A. and ETI reckon they print 60,000 magazines a month - well we calculate there is around 48,000 of you who haven't yet tried altronics for your electronic components supply. This is a pity on at least two counts. Firstly because your missing out on some real bargains on direct import quality components, and secondly because by the time you read this we will have expanded our ever growing mail order service department (over 700% growth in 12 months) to accommodate approximately 48,000 extra customers.

**PRICES/QUALITY** OK the prices are about the best in Australia right? And with our quality control, we guarantee full replacement or refund for goods returned to us (in original condition) within 14 days of purchase apart from our 100% parts and labour warranty for a full 3 months. Then all that's left is to tell you about our three brilliant delivery services.

**\$2 DELIVERY AUSTRALIA WIDE** We process your order the day received and despatch via Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 10kg's.

**\$4 DELIVERY AUSTRALIA WIDE** We process your order day received and despatch via JetService for delivery next day.

**BANKCARD HOLDERS CAN PHONE ORDER UP TO 8PM (EST) FOR NEXT DAY DELIVERY - SOUNDS INCREDIBLE DOESN'T IT?** Alright you cynics just try us! Weight limit 3.3kg's. JetService cannot deliver to P.O. box numbers (Australia Post would have a fit).

**\$10.00 HEAVY HEAVY SERVICE - AUSTRALIA WIDE** All orders over 10kg's must travel on the heavy service, that is - road express. Delivery time 7 days average.

**WHAT COSTS \$4.00 AND TRAVELS AT AROUND 130 MILES PER HOUR?** Our Jet delivery service that's what! David Nichols of Wybalena Grove, Cook Act rang us the other day to exclaim that his order phoned thru the previous day at 7.30pm (est) had just arrived (it was 10.00 o'clock next morning) "that's an average of 130 miles an hour!" Calculates Dave - - - - -strewth!

## ROTARY SWITCHES

All with 1/4 in shafts

S3002	6	POL	2POS
S3003	4	POL	3POS
S3004	3	POL	4POS
S3005	2	POL	5POS
S3006	2	POL	6POS
S3012	1	POL	12POS

**\$1.40 ea**  
10 UP \$1.20



**HEAVY DUTY RELAY AND SOCKET IDEAL FOR SWITCH 240V 12V coil DPDT contacts rated 240V AC 10 AMP includes socket**

new low price **\$7.50**



## MINI RELAY



## PRICE BREAK THROUGH ON CRADLE RELAY SOCKETS

\$4058 FOR DPDT RELAY  
\$4059 FOR 4PDT RELAY

**\$1.00** 25 UP .90

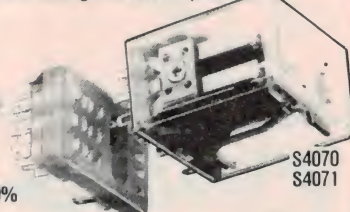


**FLASHING LED**  
5mm red led with inbuilt micro circuit were \$1.50 now **49c.**

CAT.NO	COIL VOLTS.	COIL RESIST.	CONTACT SET	MAX SW CURRENT	MAX SW CAPACITY	PRICE 1-24	PRICE 25 UP
\$4060	12	400	SPDT	1A	100VA	<b>\$1.50</b>	<b>\$1.25</b>
\$4061	12	300	DPDT	1A	100VA	<b>2.00</b>	<b>1.60</b>
\$4066	12	400	SPDT	3A	350V	<b>2.00</b>	<b>1.60</b>

## RELAYS FROM THE IMPORTER

Cradle relays, pinout compatible with itt and siemens. High sensitivity, high reliability Gold flashed contacts. \*Operate time 15ms max \*Release time 10ms max \*Insulation resistance 100 M OHM at 500 V DC \*Dielectric strength 1000 V AC (1 min)



SAVE 30%

CAT.NO	COIL VOLTS.	COIL RESIST.	CONTACT SET	MAX SW CURRENT	MAX SW CAPACITY	PRICE 1-24	PRICE 25 UP
S4067	12V	325	DPDT	2A	120VA	<b>\$4.50</b>	<b>\$3.90</b>
S4068	24V	1600	DPDT	2A	120VA	<b>4.50</b>	<b>3.90</b>
S4070	12V	185	4PDT	1A	60VA	<b>4.95</b>	<b>4.50</b>
S4071	24V	700	4PDT	1A	60VA	<b>4.95</b>	<b>4.50</b>

**SCHOOLS, UNIVERSITIES, GOVERNMENT DEPARTMENTS** Your orders are very welcome - simply post or phone your order and nominate delivery service required.

**PERSONAL SHOPPERS** Hey these great bargains are for you twot! Come see us soon - ask us for a free \$2 voucher, limit one per customer and valid for use with any purchase \$20.00 or more January/February only.

**Rush in your order NOW, we will rush it back**

BANKCARD JETSERVICE-DELIVERY NEXT DAY

AT LAST THE FABULOUS ETI 5000 STEREO PRE AMP  
(Brilliantly designed by Australia's top audio engineer David Tilbrook)



EXCLUSIVE metal film 1% resistors supplied throughout.  
EXCLUSIVE lorin low noise high reliability switches supplied.  
Kit includes absolutely all components and full instructions and includes superb instrument rack cabinet.  
**COMPLETE KIT ONLY \$245.00** — SEE ETI OCT 81

## CREDIT CARD CALCULATOR

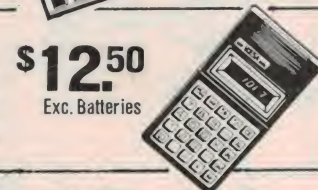
Extra thin, quality altronics import. Ideal for student, business man and overseas traveller for those currency conversions etc - and at our price who needs "Duty Free?" Slips neatly into the wallet.



Includes Wallet!  
**\$9.95**

## VOESA LCD CALCULATOR LC-5

USES 2 STANDARD PENLIGHT BATTERIES \*High visibility display \*2 years operation Plus on two 25c batteries \*Altronics Direct Import NOTE - Definitely the most easy to use calculator I have ever had - Jack O'Donnell M.D. Altronics



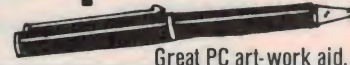
**\$12.50**  
Exc. Batteries

## NEONS

220-260V  
9mm Panel Mounting  
\$4015 Red  
\$4016 Green

**90c**  
10 UP 75c

## \$1.50 DALO PENS



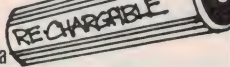
Great PC art-work aid.

## HARD TO GET SEMIS AT BARGAIN PRICES

2N6027 PUT <b>65c</b>	MPF105 <b>50c</b>	BF470 <b>\$1.00</b>	UAA 170 <b>\$3.80</b>
BF115 <b>75c</b>	LM380 <b>\$1.60</b>	VN88AF VMOS <b>\$3.95</b>	2N3055 <b>85c</b>
MPF102 <b>55c</b>	CA3140 <b>\$1.25</b>	MEL12 PHOTO <b>95c</b>	BUX80 <b>7.95</b>
HF/VHFFET <b>50c</b>	BF469 <b>\$1.00</b>	DARLINGTON <b>95c</b>	BU208 <b>4.20</b>
		LAM3915 LED <b>\$3.50</b>	LM317K <b>2.95</b>
		BAR/ODT ORVR	LM309K <b>3.50</b>
			TA7205 <b>2.95</b>
			MPF105 <b>50c</b>
			LM339 <b>1.75</b>

## PRICE CRASH ON AA NICADS

Quality Matsushita manufacture 1.2v 500mah



**\$1.50**

## INFRA RED LED SAVE 60%

Philips COY89A

1-24 25-99 100 up

**75c 65c 55c**



## ETI 5000 MOSFET AMP MOSFET BARGAINS

\*Audio Power module kit \$59.95 (1 channel) \*Power transformer \$37.50 with copper flux strap \*Electro's 8000 MF/75V \$9.50 \*Mosfet semi's hitachi 2SK134, 2SJ49 \$6.00 ea.

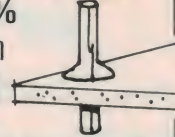


\*COMPLETE AMP KIT \$289.00  
Includes superb finish front panel/heat-sink and every last nut and bolt, even solder! FULL INSTRUCTIONS INC.

## PC STAKES (PINS) SAVE 33%

Pack 100 (ave)

**\$2.00** only



## NEW OP AMPS

Used in the 5000 series preamp



NE5534N **\$1.25** 10 up \$1.15  
NE5534AN **\$1.95** \$1.85

## Bitsav RESIN CORE SOLDER

\$1.00 OFF 200g reel Lab grade 1mm diam BARGAIN



**\$3.95** 10 UP **\$3.50**

**ALTRONICS**  
105 Stirling St. PERTH  
(09) 328 1599  
for instant service

ALL MAIL ORDERS:  
BOX 8280 PERTH  
Stirling St. WA 6000

BANKCARD JETSERVICE-DELIVERY NEXT DAY

BANKCARD JETSERVICE-DELIVERY NEXT DAY



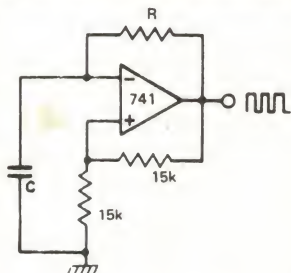
# Circuit source guide

Here is an abundance of circuits that should prove a useful, if not informative, source from which you can derive other circuits or assemble a circuit from a variety of 'blocks' to suit a particular application or solve a circuit problem. Tim Orr has assembled this anthology, covering applications that range from dc control to digital instrumentation, preamps to power supplies and more. You may have seen some of these ideas before, but there are bound to be plenty you haven't.

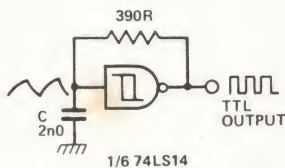
You'll find device pinouts on the last page and a guide to purchasing components in Shoparound in this issue. Notes have been appended to some circuits by David Tilbrook.

## GENERATORS

### Op-amp Oscillator TTL Oscillator

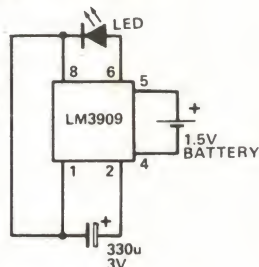


$$F \sim \frac{1}{RC} \text{ (rule of thumb)}$$

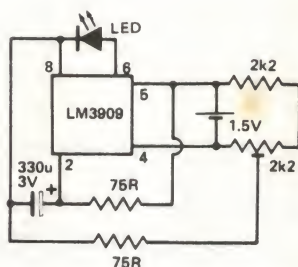


Vary C to change frequency  
Do not increase the size of the 390R resistor  
Frequency range = 1 Hz to 1 MHz

### LED Flasher

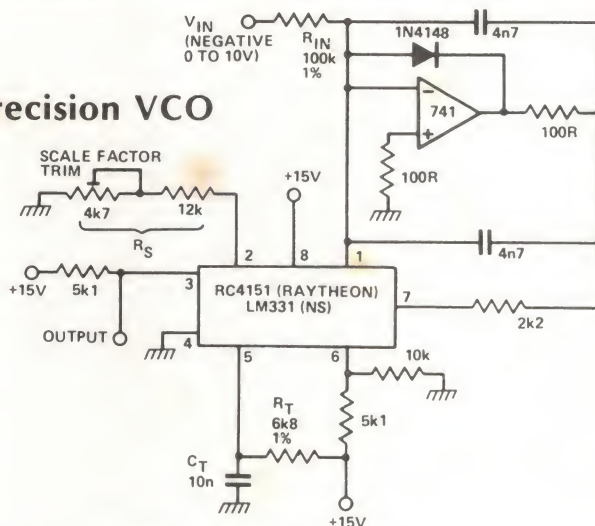


1 Hz flash rate  
Average current drain = 0.32 mA  
Circuit uses the timing capacitor to boost the output voltage



Variable flash rate 0 to 20 Hz

### Precision VCO



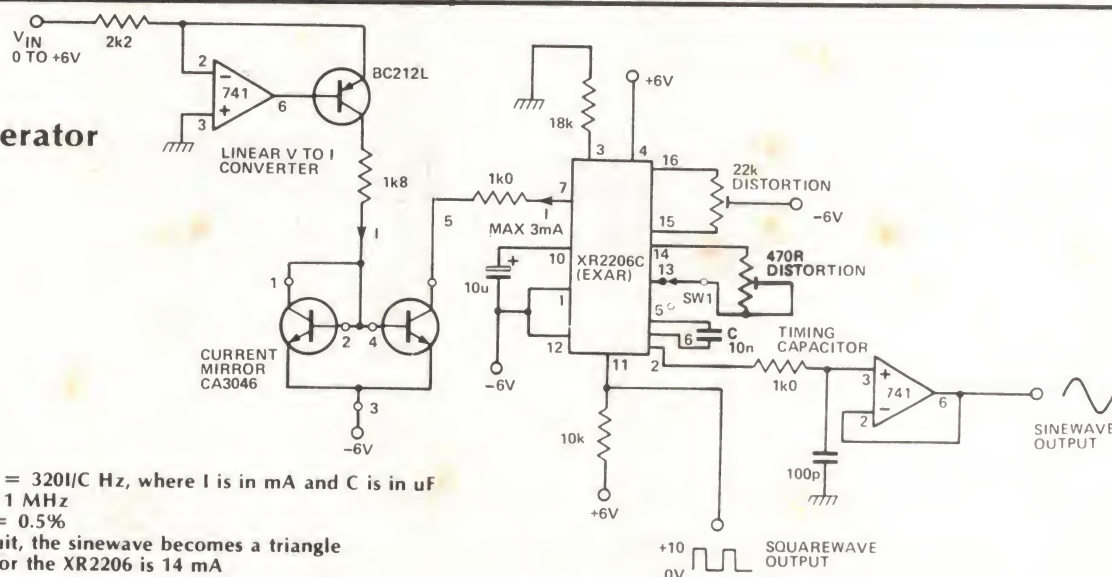
$$F = (-V_{IN})/2.09 \times (R_S/R_{IN}) \times 1/(R_T C_T) \text{ Hz}$$

Maximum frequency = 10 kHz  
Linearity = 0.05%  
Response time = 10 us  
Op-amp powered from  $\pm 15$  V

The LM331 is a precision voltage-to-frequency converter. In this application an additional op-amp is used to facilitate immediate response to changes of the input control voltage. The other advantage of the use of an additional op-amp is an increase in the sensitivity of the circuit to low control voltages. The limit here is the offset voltage and current for the particular op-amp used. The 741 specified is satisfactory although an improvement would be obtained if alternative devices were used, e.g. LM108, LM308A or LF351B.

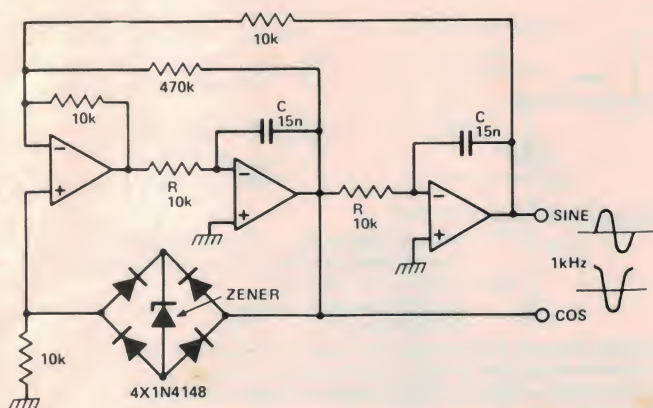
Note that the 4n7 capacitor in the integrator should be a mylar capacitor to ensure accurate operation.

### Function Generator



Oscillation frequency  $F = 320I/C$  Hz, where I is in mA and C is in uF  
Maximum frequency = 1 MHz  
Best THD of sinewave = 0.5%  
When SW1 is open-circuit, the sinewave becomes a triangle  
Typical supply current for the XR2206 is 14 mA





## Dual Integrator Oscillator

Quadrature outputs (ie sine and cosine)

$$\text{Output frequency } F = \frac{1}{2\pi RC} \text{ Hz}$$

To change frequency, change both R's or both C's.

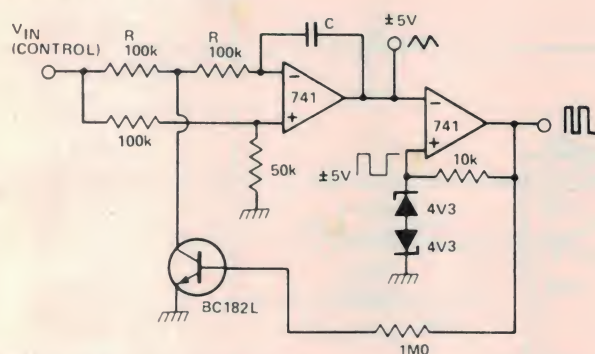
Maximum frequency  $\sim 20 \text{ kHz}$

Minimum frequency  $\sim 0.016 \text{ Hz}$  using  $C = 1\mu\text{F}$ ,  $R = 10\text{M}$ , and TL081 op-amps

Oscillation amplitude  $= 2 \times (\text{zener voltage} + 1\text{V}) V_{pp}$

This oscillator provides two sinewave outputs with a phase shift of  $90^\circ$  with respect to each other, i.e: sine and cosine waveforms. The output frequency is relatively stable provided good components are used, and distortion figures below 0.1% are easily obtained.

## Linear VCO



Triangle and square wave outputs

$$\text{Output frequency } F = (1.667 \times 10^{-7} \times V_{IN}) / C \text{ Hz}$$

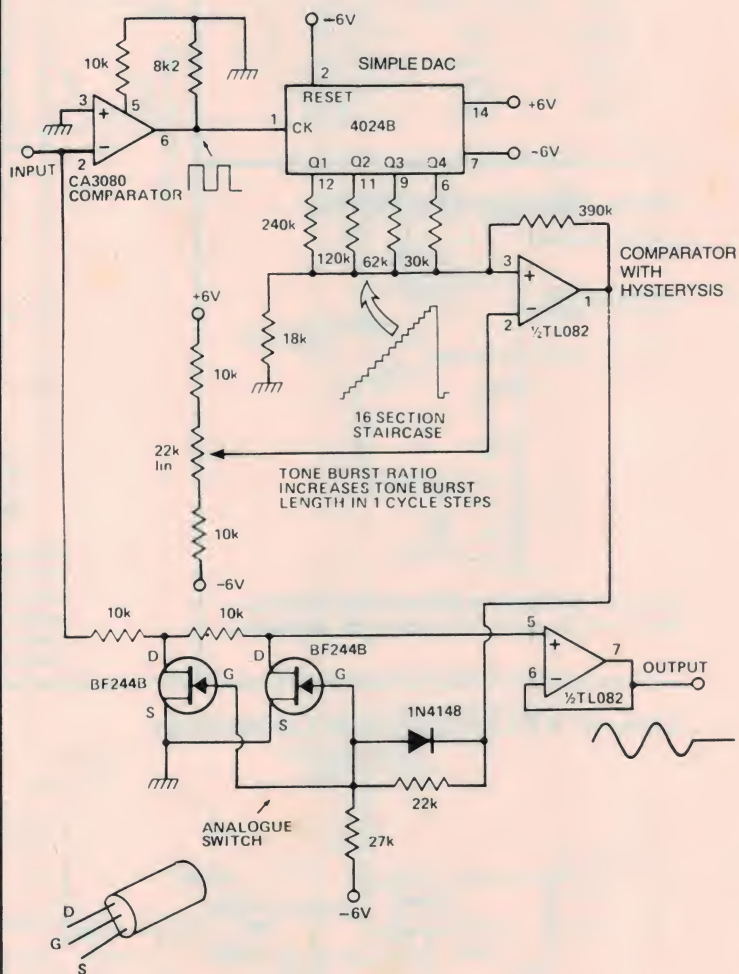
If  $C = 1\text{nF}$  and  $V_{IN} = 10\text{V}$ , then  $F = 1.66 \text{ kHz}$

Changing both R's from 100k to 10k will increase F by  $\times 10$

For low frequencies use TL081 op-amps

Frequency range 0.1 Hz to 10 kHz

## Variable Length Tone Burst Generator



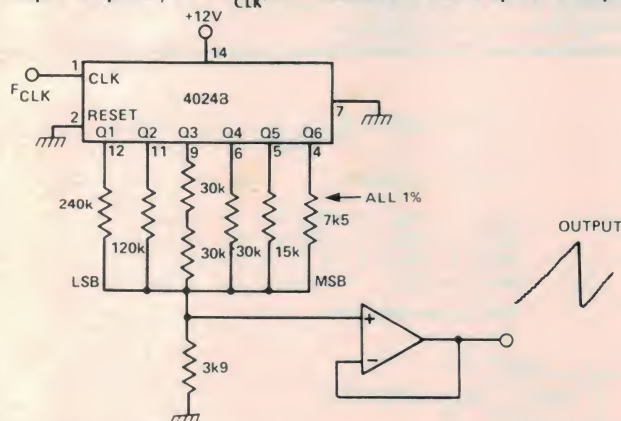
Input is a sinewave or any other periodic waveform, maximum level  $\pm 2 \text{ V}$ , maximum frequency 100 kHz

Output is a tone burst variable from one cycle on, 15 cycles off to 15 cycles on, one cycle off

All devices powered from  $\pm 6 \text{ V}$

## Staircase Generator

Output frequency  $F = F_{CLK} / 64$  Staircase is made up of 64 steps

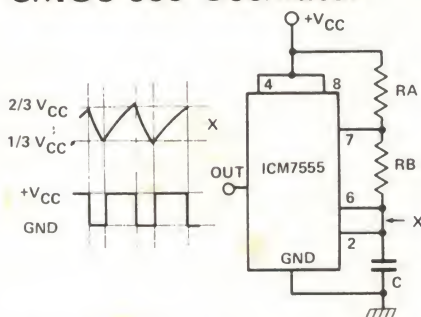


The 4024B is a CMOS seven-stage binary ripple counter. Upon receipt of a clock pulse the counter selects a combination of the resistors and increases the voltage at the output of the op-amp buffer. As with all edge-triggered devices the clock should be conditioned to have a single clean edge with a rise and fall time faster than 5  $\mu\text{s}$ . The device clocks on the falling edge of the clock waveform.



## GENERATORS

### CMOS 555 Oscillator

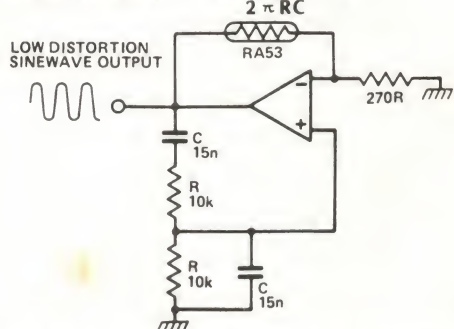


Output frequency  $F = 1.46/C(RA + RB)$   
 C in farads, R in ohms  
 Quiescent current  $\sim 120 \mu A$   
 Input current  $\sim 50 pA$  (this allows the use of resistors up to 10M in value)  
 Frequency range 0.001 Hz to 500 kHz  
 Supply range 2 to 18 V  
 Rise and fall time (pin 3) = 40 ns

RA, RB	C	F
10M	10 $\mu$ TANT	7.3 mHz
1M	1 $\mu$	0.73 Hz
100k	100n	73 Hz
10k	10n	7.3 kHz
10k	1n	73 kHz

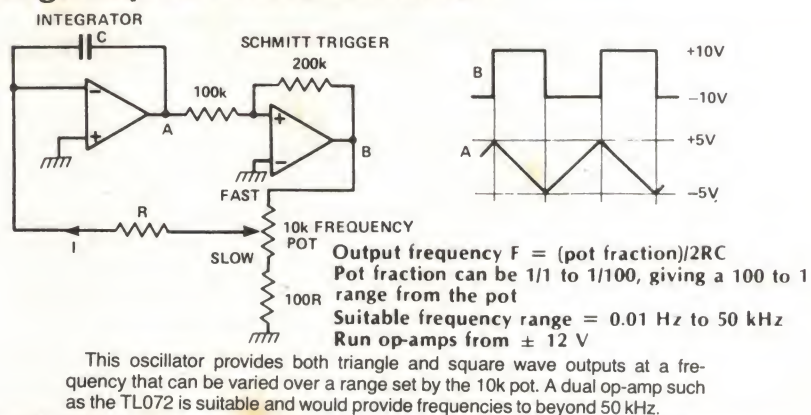
### Wien Bridge Oscillator

Output frequency  $F = \frac{1}{2\pi RC}$  Hz



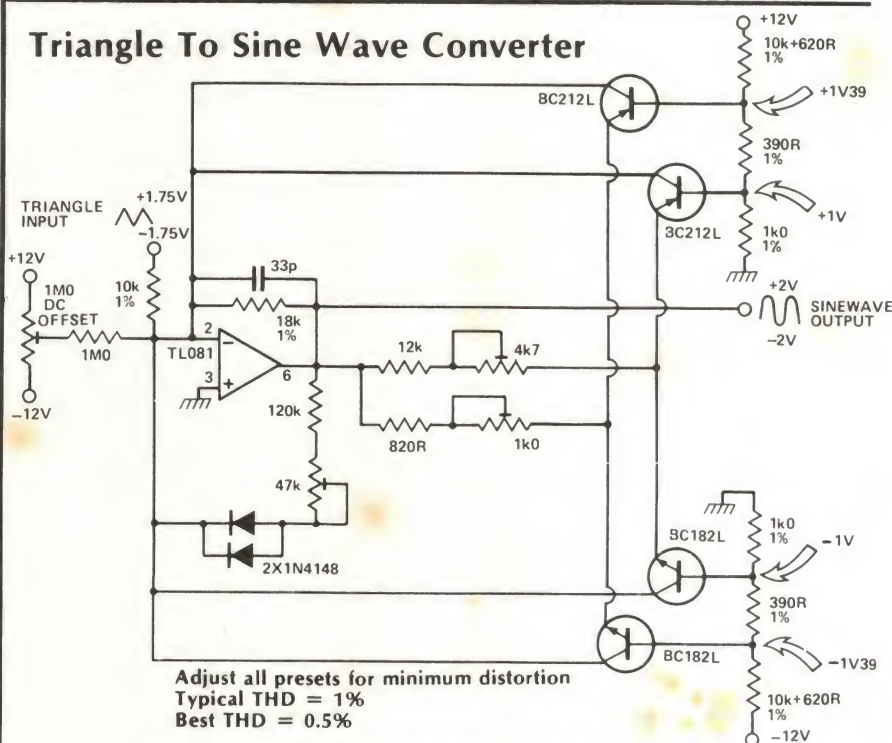
The RA53 is a negative temperature coefficient thermistor; it sets  $A_v$  to 3 for stable oscillation.

### Triangle/Square Wave Oscillator



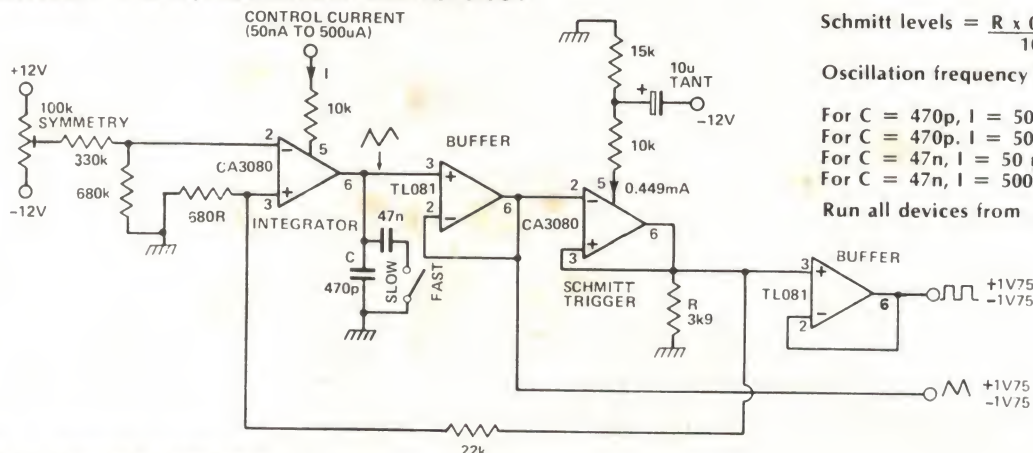
This oscillator provides both triangle and square wave outputs at a frequency that can be varied over a range set by the 10k pot. A dual op-amp such as the TL072 is suitable and would provide frequencies to beyond 50 kHz.

### Triangle To Sine Wave Converter



When designing a complete function generator it is often convenient to start with one of the triangle/square wave oscillators given earlier and convert the triangle wave into a sine wave. This is a particularly good method if a sweep oscillator is required, since sine wave sweep oscillators are extremely difficult to design. Some experimenting with the preset pots is necessary to obtain minimum distortion, although this is not particularly difficult.

### Linear VCO/Function Generator



$$\text{Schmitt levels} = \frac{R \times 0.449}{1000} = 3.9 \times 0.449 = \pm 1V75$$

$$\text{Oscillation frequency } F = 1/(C \times 4 \times 1.75) = 1/7C \text{ Hz}$$

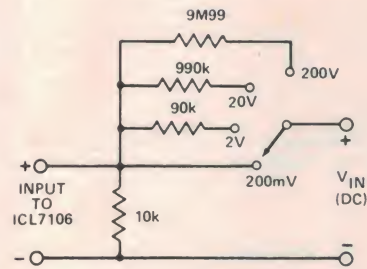
For C = 470p, I = 50 nA, F = 15 Hz  
 For C = 470p, I = 500 uA, F = 150 kHz  
 For C = 47n, I = 50 nA, F = 0.015 Hz  
 For C = 47n, I = 500 uA, F = 150 Hz

Run all devices from  $\pm 12$  V

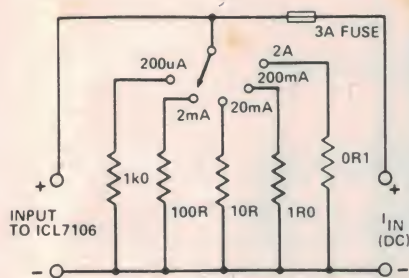
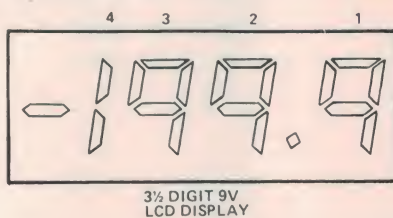


## MEASUREMENT

### 3½ Digit LCD DVM

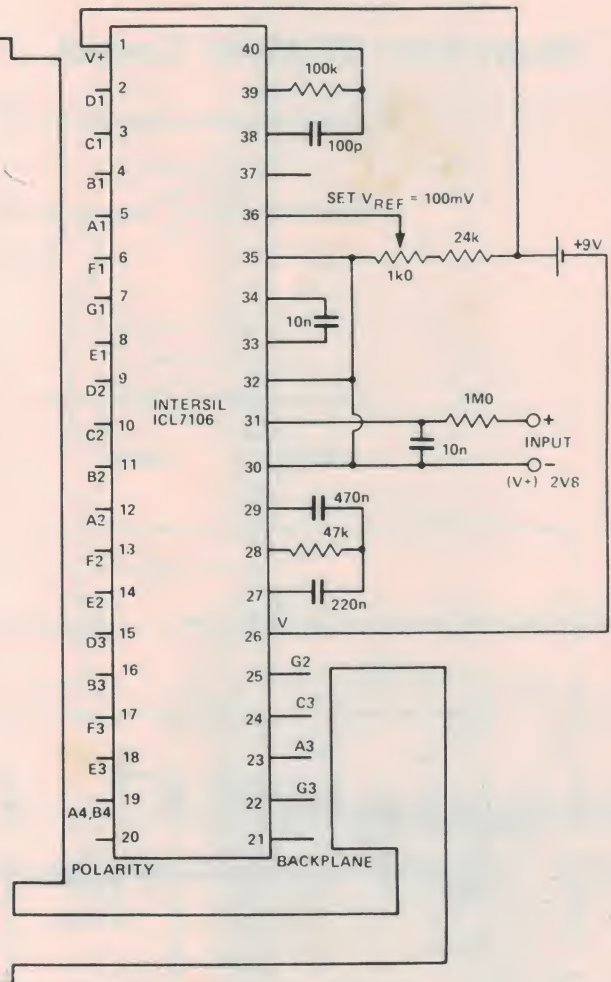


DC voltage inputs



DC current inputs

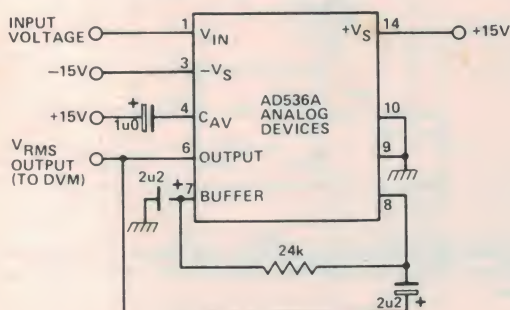
Input voltage range =  $\pm 200$  mV  
 Quiescent current = 0.8 mA  
 Common mode input range =  $(V+) - 0V5$  to  $(V-) + 1V$   
 Decimal point must be driven externally by EXORing the decimal point data with the backplane strobe



The Intersil ICL7106 is a high-performance CMOS 3½-digit analogue-to-digital converter capable of driving a liquid crystal display directly. The device uses dual-slope integration to ensure accurate performance independent of component variation. The accuracy is guaranteed to  $\pm 1$  count in 2000 counts and draws only 10 mW from a 9 V battery. Intersil market a 'Single Chip Panel Meter Evaluation Kit' that contains all the necessary components for this circuit.

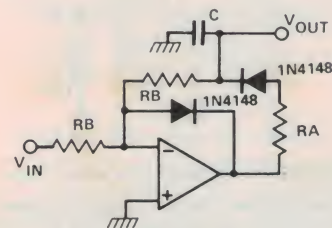
### True RMS Measurement

Input voltage 7  $V_{RMS}$  maximum  
 Bandwidth: 300 kHz,  $V_{RMS} > 0V1$   
 Error of 1% for a crest factor of 7  
 Quiescent current = 1mA  
 60 dB range



### Inverting Peak Voltage Detector

Attack time constant =  $C.RA$   
 Decay time constant =  $C.RB$

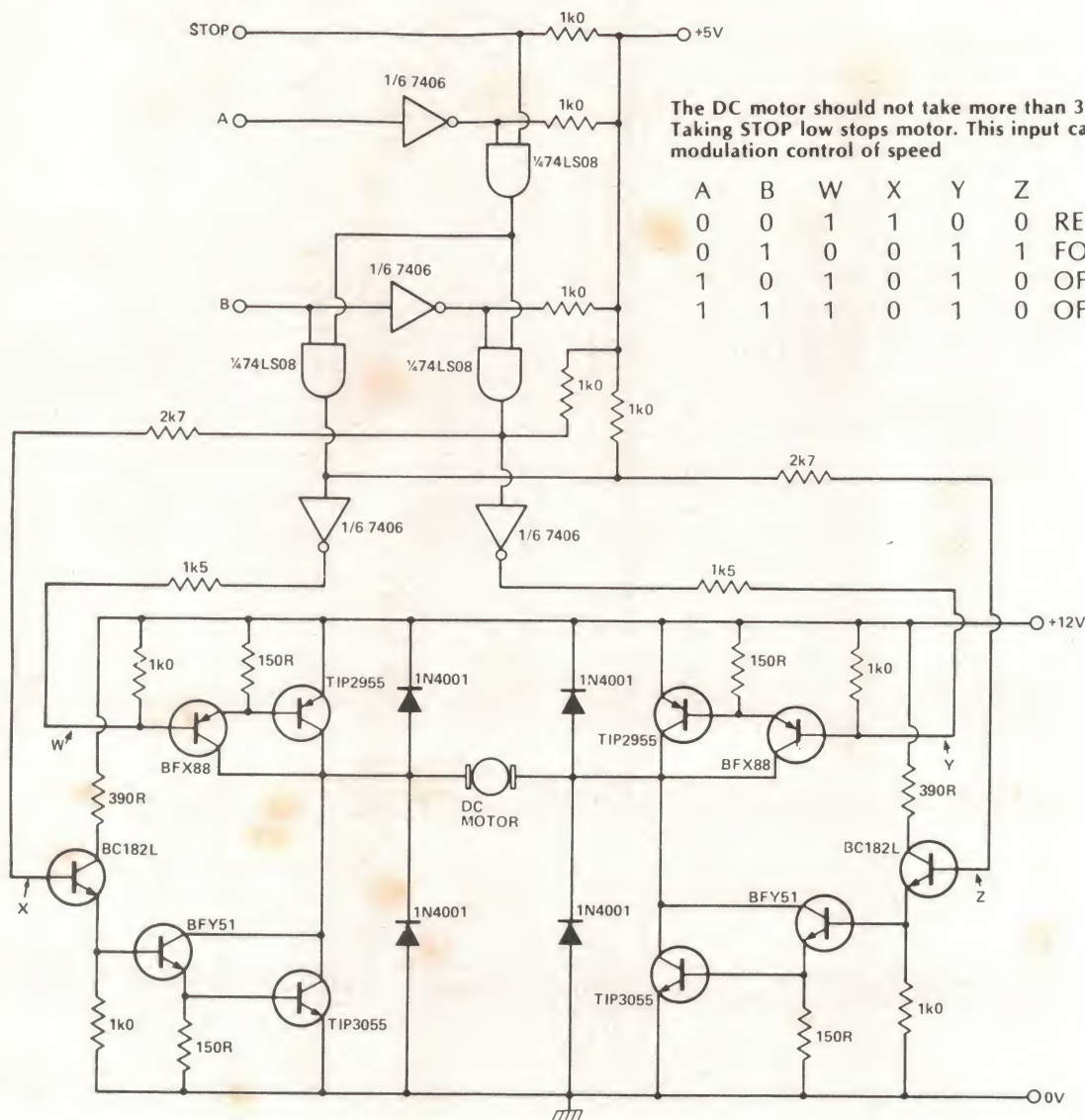


This circuit works well at high frequencies

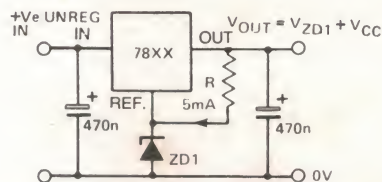


## POWER SUPPLIES/DC CONTROL

### Heavy Duty DC Motor Control



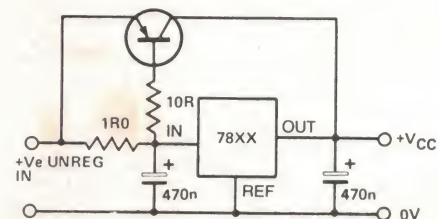
### Increasing Regulator Voltages



Increasing the output voltage using a zener diode.

The output voltage of three-terminal voltage regulators can be increased by increasing the voltage on the reference or common lead on the regulator. This can be done as shown in the circuit diagram with the use of a zener diode. The resistor R should be selected to ensure sufficient current through the zener for a stable voltage reference.

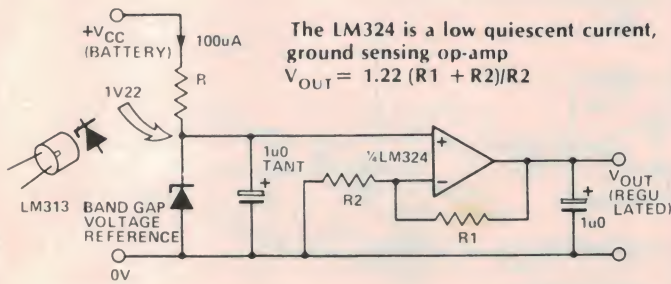
### Increasing Regulator Currents



Using a bypass transistor to increase the output current drive. The first 600 mA flows through the regulator, the rest via the external transistor.

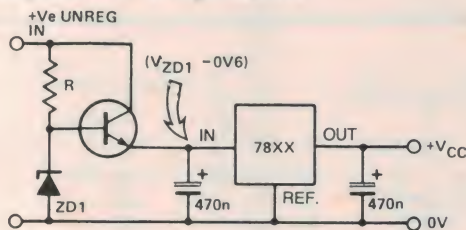


## Low Current/Precision Supply



This circuit is useful whenever a precision voltage reference is necessary or as a low current, well-regulated supply. The value of the resistor R is calculated from the battery voltage to ensure around 1 uA through the LM313. Use the equation  $R = V_{CC} \times 1000 \text{ ohms}$ .

## Low Dissipation Regulator

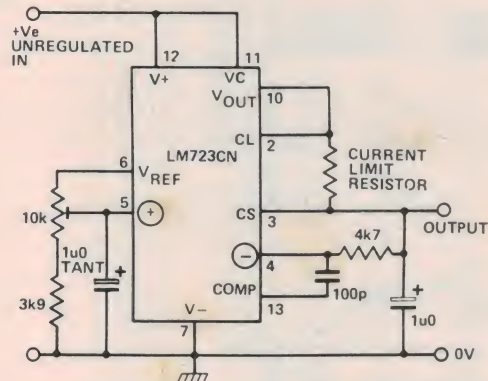
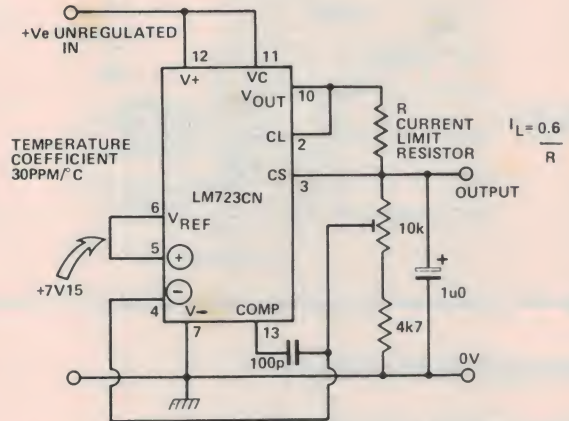


The three-terminal IC regulator is probably the most-used integrated circuit, offering a simple and effective solution to the problem of power supply design. These devices, however, have a maximum input voltage of around 35 V (40 V for some). The circuit shown here enables the regulator to function from a higher supply voltage by dropping the excess voltage across an external transistor. You should ensure that the voltage drop across the transistor is within the capabilities of the particular device used. The zener diode ZD1 sets the voltage that appears at the input of the IC regulator. (The actual voltage will be  $ZD1 - 0.6$ ). The resistor R should be selected to ensure adequate current through the zener diode so that it will provide an effective voltage reference for the pass transistor. This is determined by the maximum power dissipation of the zener. Set the required power dissipation for the zener at about half its maximum rating then calculate the required zener current from Ohm's law; i.e.  $I = P/ZD1$ . The value of the required resistor is then given by  $R = (V_e - ZD1)/I$ .

The circuit can also be used to decrease the power dissipation in the IC regulator. These require an input at least 2-3 volts above their rated output voltage. If this voltage is set by the zener the remainder of the power dissipation will be done by the pass transistor. Once again, ensure that the maximum power dissipation expected of the transistor is within its capability. If the device becomes excessively hot an additional heatsink should be used.

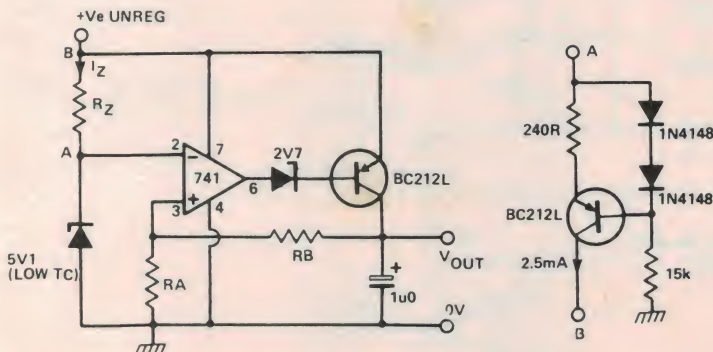
## Precision Power Supplies

723 general specifications:  
 Maximum input voltage = 40 V  
 Maximum current output = 150 mA  
 Output voltage range = 2 to 37 V



The 723 is a precision, variable voltage regulator. Output voltage is adjusted by the 10k preset and a current limit can be set by a suitable choice of resistor R.

## Battery Regulator



A very low dropout voltage can be obtained by allowing Q1 to saturate. This gives maximum lifetime on battery power.

Better regulation can be obtained by replacing RZ with this 2.5 mA current source. However, the unregulated supply rail must not drop below  $(5V_1 + 1V_2) = 6V_3$

Select  $R_Z$  for an  $I_Z$  of about 2.5 mA

$V_{OUT} = 5V_1 \times (R_A + R_B)/R_A$

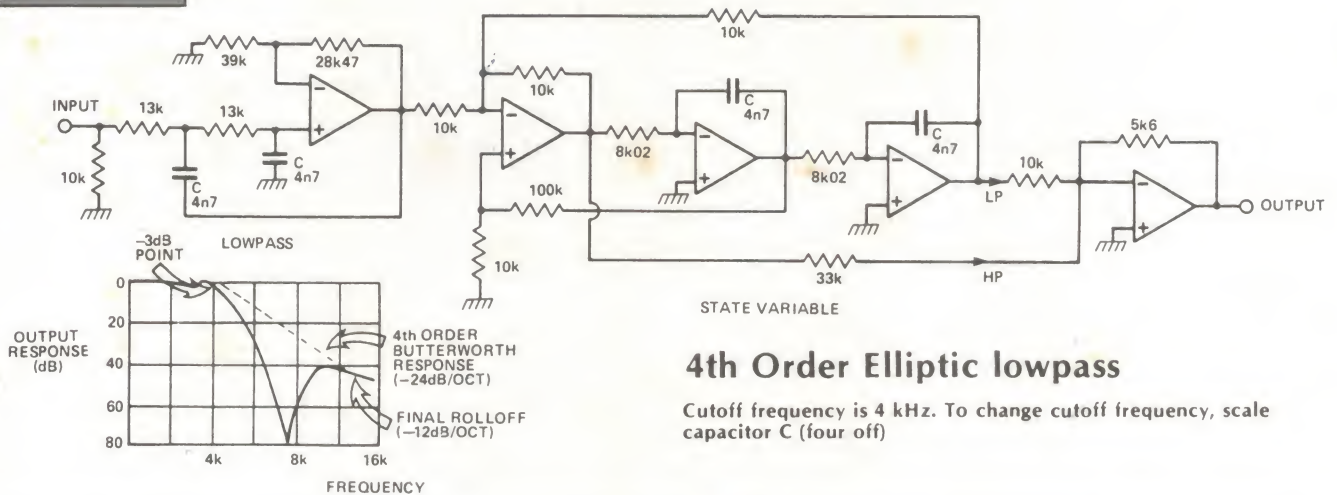
Minimum  $V_{OUT} \sim 6V$

Dropout voltage =  $V_{CE}(Q1 \text{ saturated}) \sim 0V_3$

Keep  $I_{OUT}$  less than 50 mA



# FILTERS



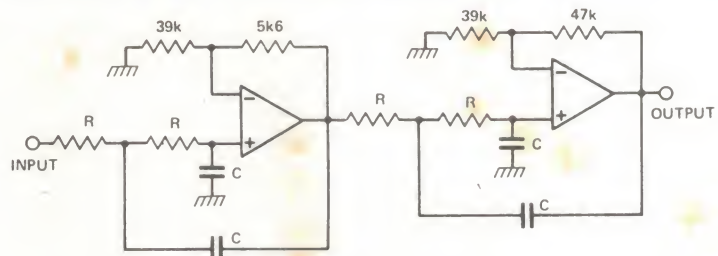
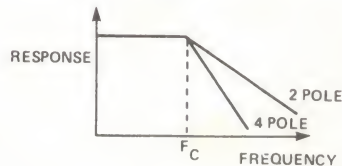
## Lowpass Active Filters

Inputs must have a DC path to ground

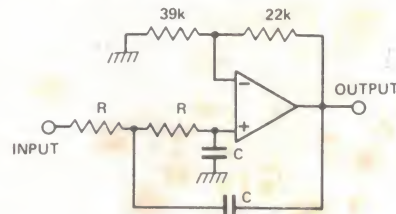
$$F_c = \frac{1}{2\pi RC}$$

2 pole roll-off = -12 dB/octave  
4 pole roll-off = -24 dB/octave

R	C	F <sub>c</sub>
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10 kHz



4 pole Butterworth



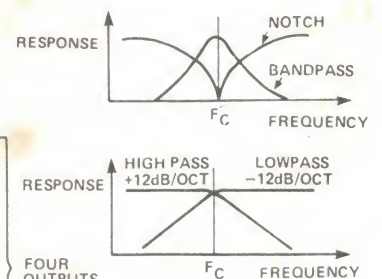
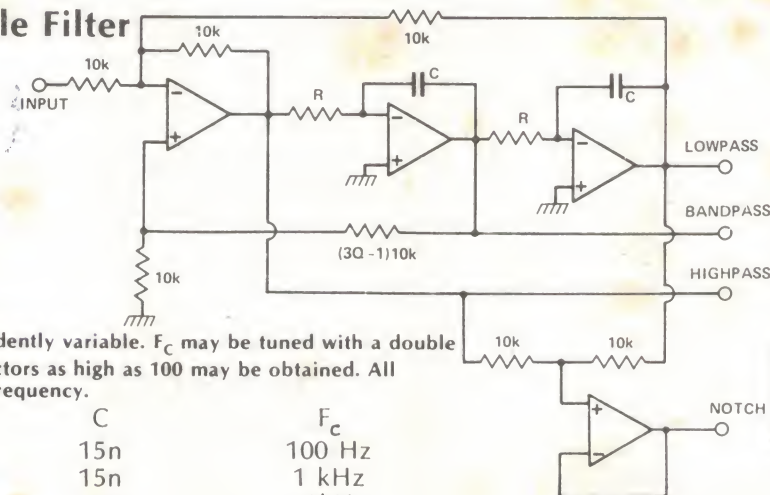
2 pole Butterworth

## State Variable Filter

$$F_c = \frac{1}{2\pi RC} \text{ Hz}$$

Gain = Q  
Q and F<sub>c</sub> are independently variable. F<sub>c</sub> may be tuned with a double gang pot (for R). Q factors as high as 100 may be obtained. All responses track with frequency.

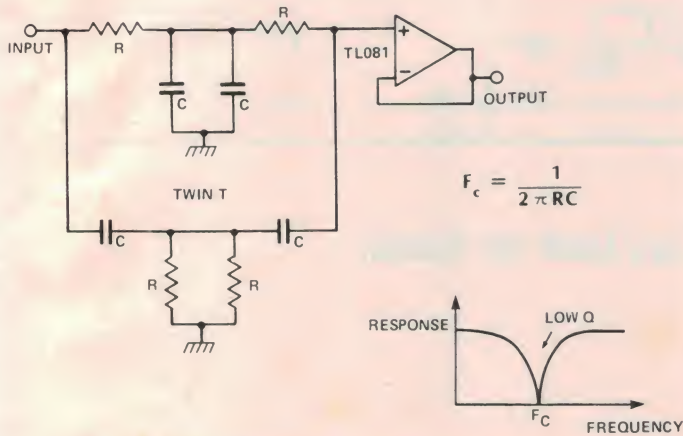
R	C	F <sub>c</sub>
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10kHz





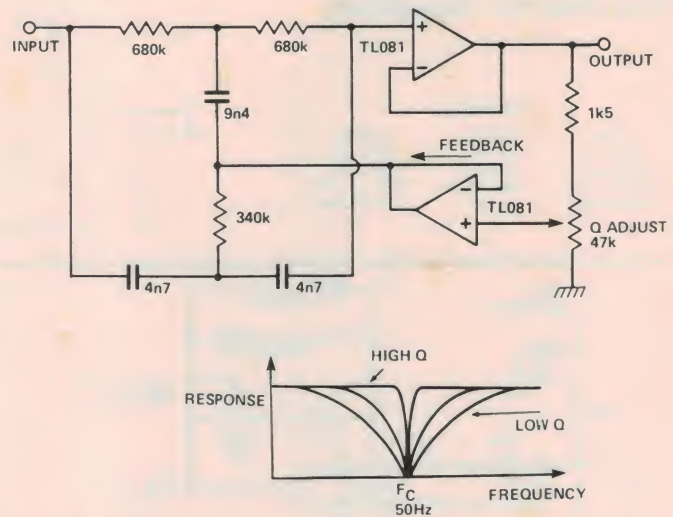
## Active Notch Filter

The two R's in parallel represent R/2  
The two C's in parallel represent 2C  
For 50 Hz, R = 680k, C = 4n7 (a hum remover)



A basic Twin-Tee notch. Rejection depends on component matching, so for best results use high-stability components.

## 50 Hz Notch, Variable Q



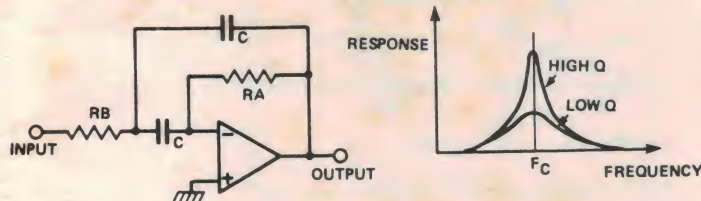
This is a modified version of the basic Twin-Tee notch filter. The Q can be adjusted by controlling the amount of feedback with the 47k potentiometer. The rejection offered by the circuit is determined by the matching of the passive components, but even with ordinary components a figure of 30 dB to 40 dB should be obtained.

## Bandpass Active Filter

$$F_c = \frac{1}{2\pi C \sqrt{R_A + R_B}}$$

$$Q = \frac{1}{2} \sqrt{R_A / R_B}$$

$$\text{Gain} = 2Q^2$$



$$F_c = 1\text{kHz}, C = 15\text{n}$$

RA	RB	Q	GAIN
10k6	10k6	0.5	x 0.5
21k2	5k3	1.0	x 2.0
42k4	2k65	2.0	x 8.0
84k8	1k32	4.0	x 32.0

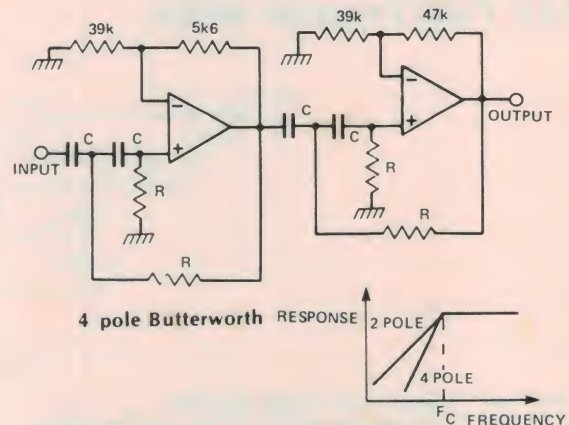
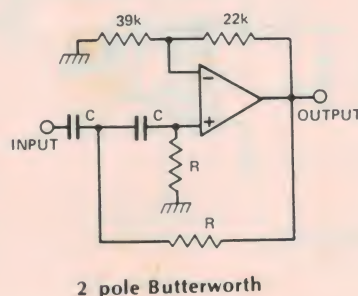
This is probably the most common bandpass filter. The circuit is really only useful for the relatively low Q shown. For a higher Q one of the more complex bandpass circuits should be used, such as the state variable filter.

## Highpass Active Filters

$$F_c = \frac{1}{2\pi RC} \text{ Hz}$$

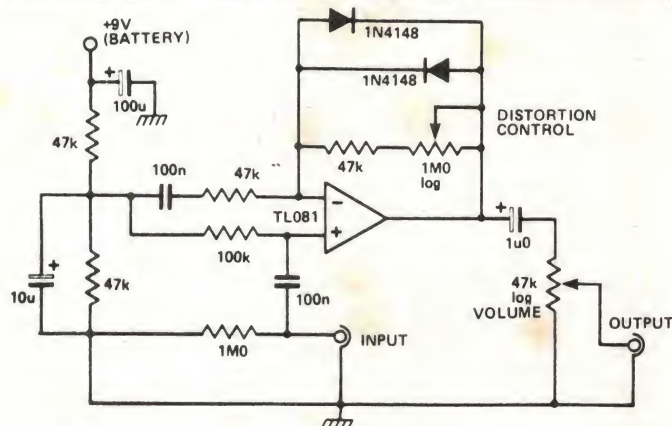
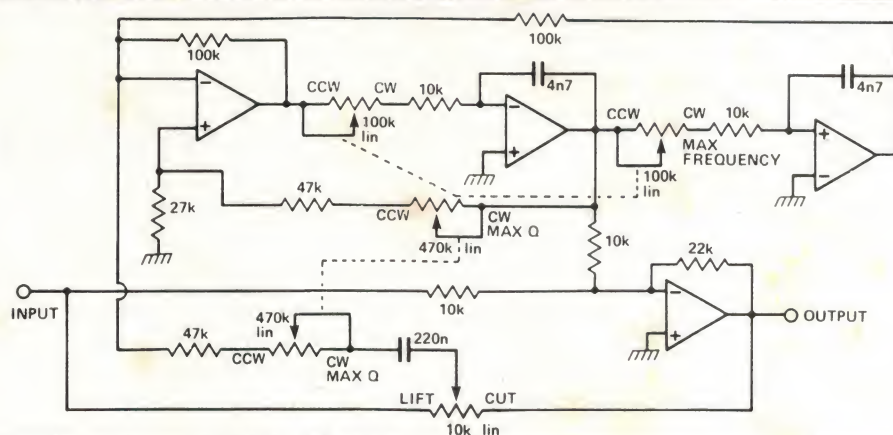
2 pole roll-off = +12 dB/octave  
4 pole roll-off = +24 dB/octave

R	C	Fc
107k	15n	100 Hz
10k7	15n	1 kHz
10k7	1n5	10 kHz





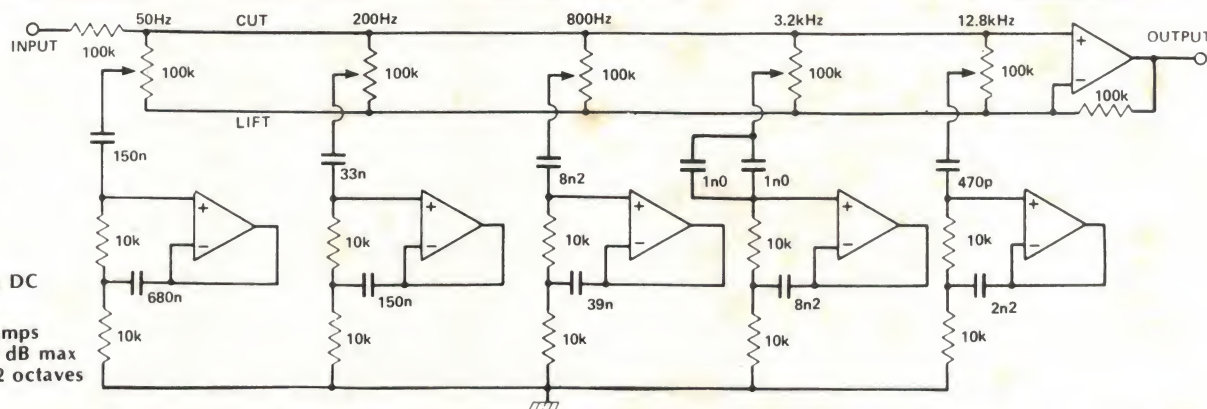
## Parametric Equaliser



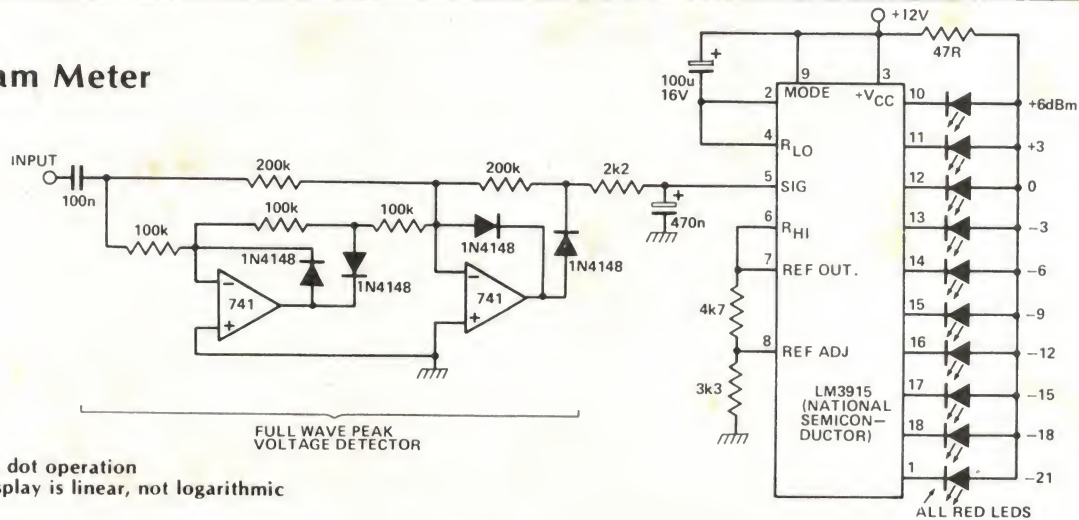
**The battery can be switched on via the jack socket (a stereo jack can be used).**



**Input must have a DC path to ground**  
**Use 741's for op-amps**  
**Cut and lift = 13 dB max**  
**Filter spacing = 2 octaves**



## LED Peak Program Meter



Leave pin 9 open circuit for dot operation  
If an LM3914 is used the display is linear, not logarithmic



## AUDIO

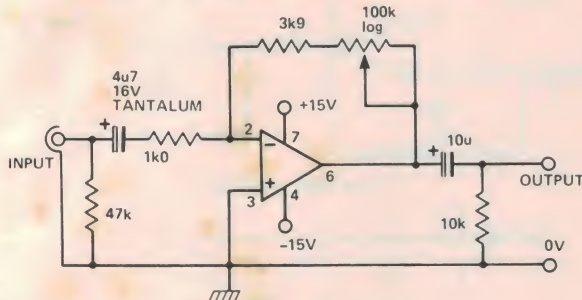
### Low Impedance Source Preamp

Very low input noise

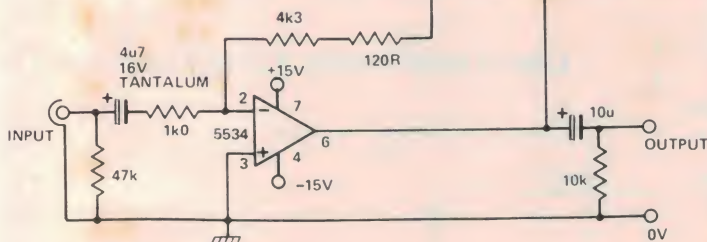
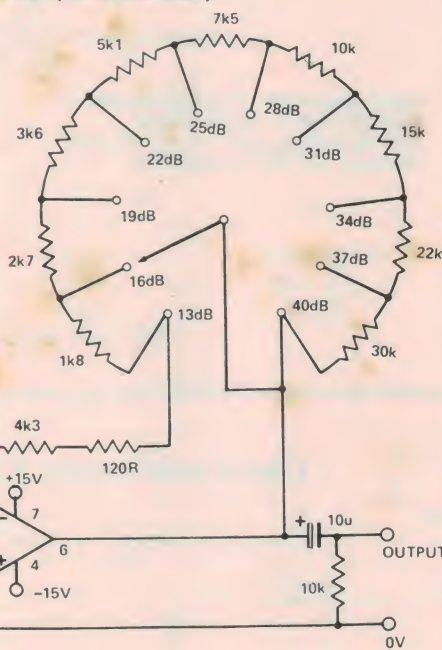
Input noise =  $4 \text{ nV}/\sqrt{\text{Hz}}$

Equivalent input noise voltage =  $0.56 \text{ uV}_{\text{RMS}}$  (20 kHz bandwidth)

Input impedance =  $1 \text{ k}\Omega$  (suitable for microphone)



Variable gain; x 3.9 to x 100 (12 dB to 40 dB)

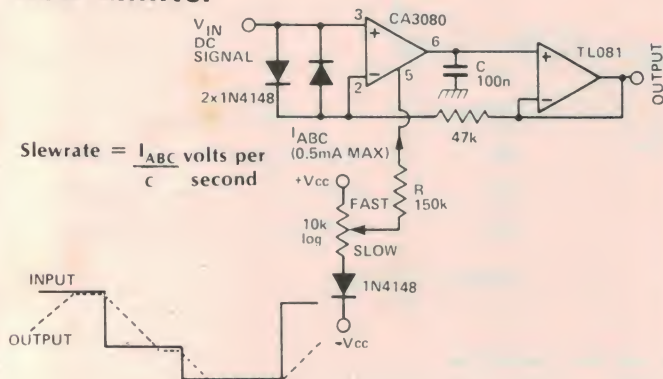


Switched gain; 3 dB steps

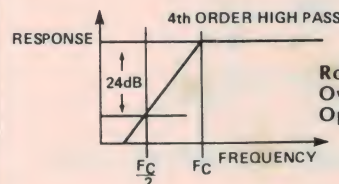
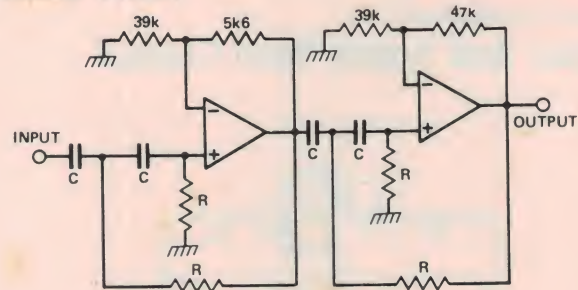
The NE5534N is a very low-noise op-amp specifically intended for audio applications. The device boasts one of the lowest noise figures of all op-amps combined with good slew rate and large signal bandwidth figures.

The lowest-noise devices have the designation NE5534AN. Suitable supply decoupling is essential if best results are to be obtained.

### Slew Limiter



### Rumble Filter

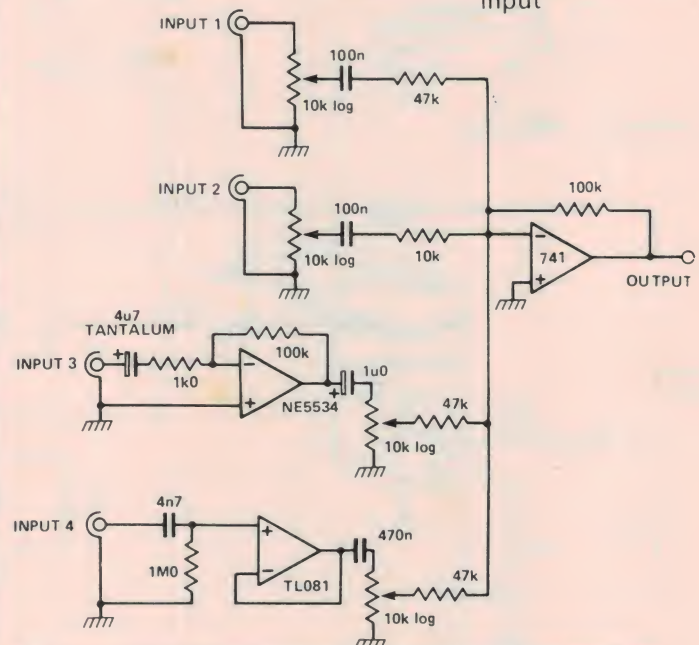


Roll-off slope = 24dB/octave  
Overall voltage gain = x 2.6 (8.3 dB)  
Op-amps are 741's or RC4558

$F_c$	C	R
25 Hz	100n	62k
50 Hz	100n	30k
100 Hz	100n	15k
200 Hz	100n	7k5
(5% tolerance)		

### Simple Mixer

INPUT	MAX GAIN	INPUT IMPEDANCE	SOURCE
1	+6 dB	10k	line level
2	+20 dB	5 to 10k	line level
3	+46 dB	1k0	low impedance microphone
4	+6 dB	1M0	high impedance input

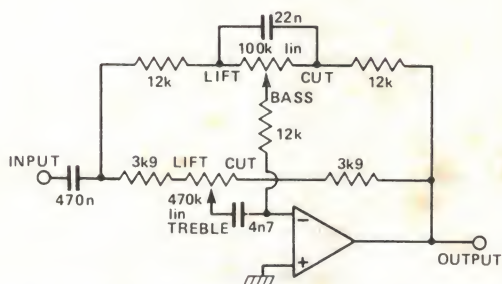


This simple mixer has been provided with four different types of input circuit. Any combination of these could however be used. Once again, the 741 limits the high frequency response and slew rate capabilities. To improve performance substitute the 741 for a faster device such as an NE5534N or TL071, etc.



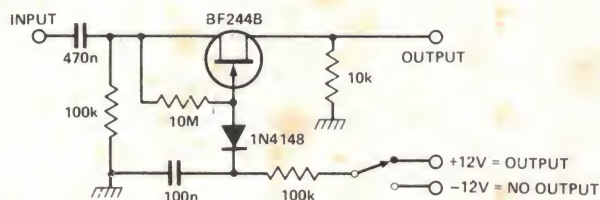
## AUDIO

### Bass And Treble Tone Control

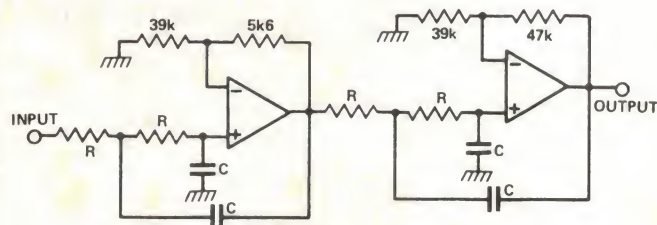


The op-amp can be any type suitable for audio work, e.g: TL071, NE5534N, etc.

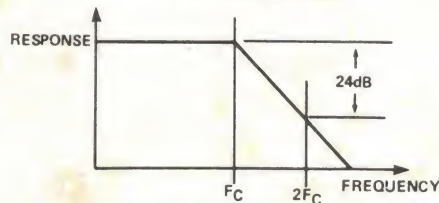
### FET Audio Switching



### Scratch Filter



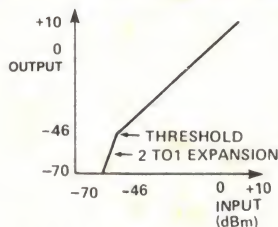
4th ORDER LOW PASS



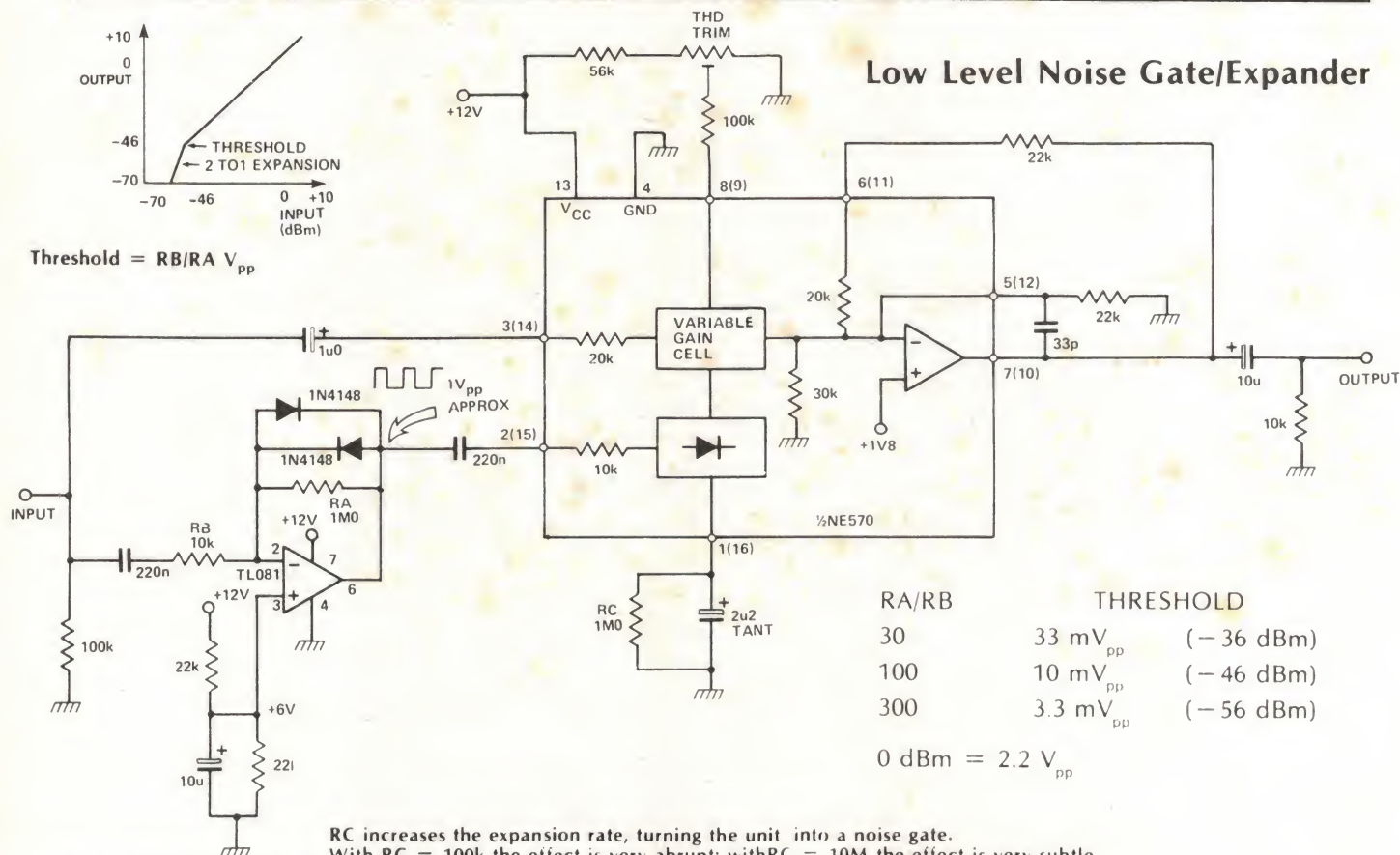
Input must have a DC path to ground  
Roll-off slope = 24 dB/octave  
Overall voltage gain = x 2.6 (8.3 dB)  
Op-amps are 741's or RC4558

$F_c$	C	R
10 kHz	1n5	10k
7.5 kHz	1n5	14k
5 kHz	1n5	20k

(5% tolerance)



$$\text{Threshold} = \frac{R_B}{R_A} V_{pp}$$



### Low Level Noise Gate/Expander

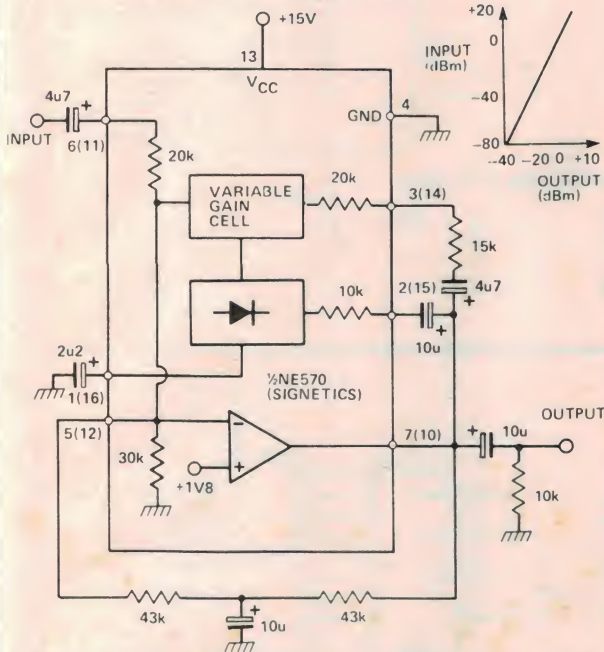
RA/RB	THRESHOLD	
30	33 mV <sub>pp</sub>	(-36 dBm)
100	10 mV <sub>pp</sub>	(-46 dBm)
300	3.3 mV <sub>pp</sub>	(-56 dBm)

$$0 \text{ dBm} = 2.2 V_{pp}$$

RC increases the expansion rate, turning the unit into a noise gate.  
With RC = 100k the effect is very abrupt; with RC = 10M the effect is very subtle.

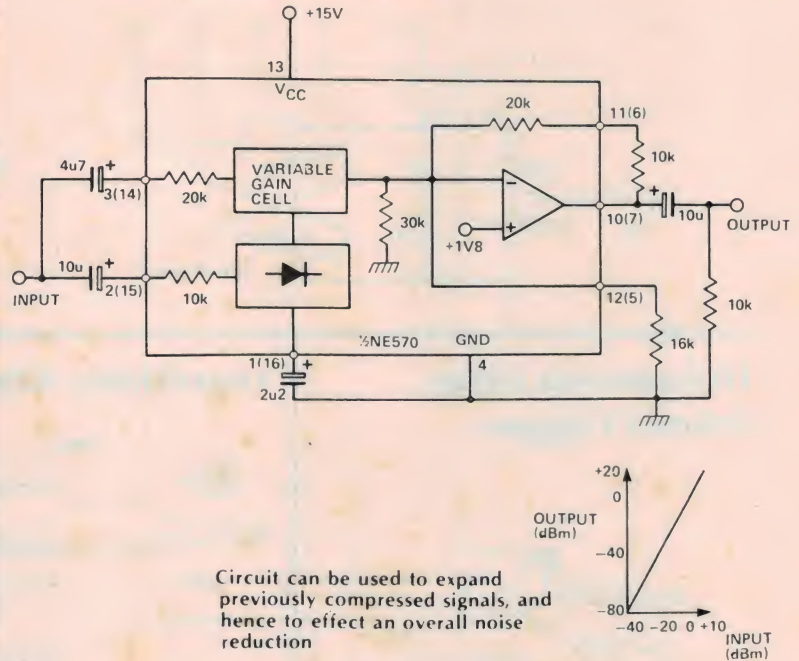


## Two-to-one Compressor



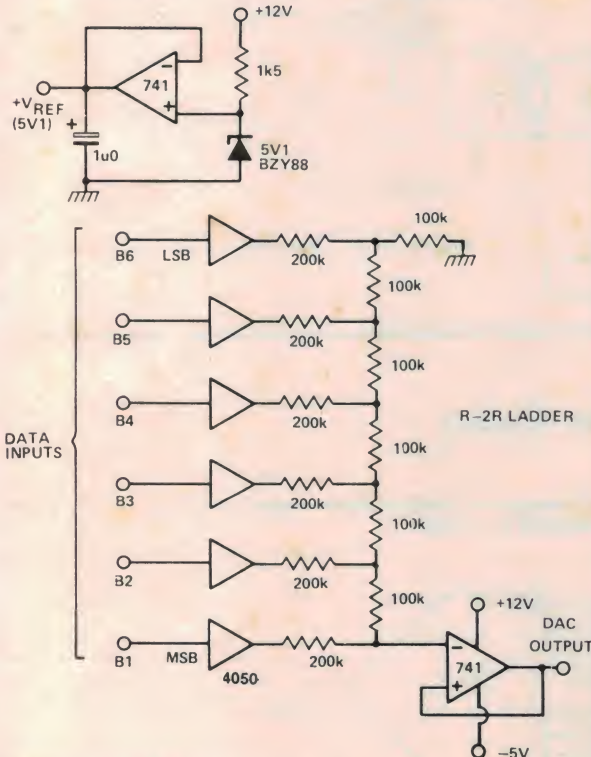
The pin numbers in brackets refer to the second circuit in the IC. Circuit can be used as a preconditioner in a noise reduction system.

## Two-to-one Expander

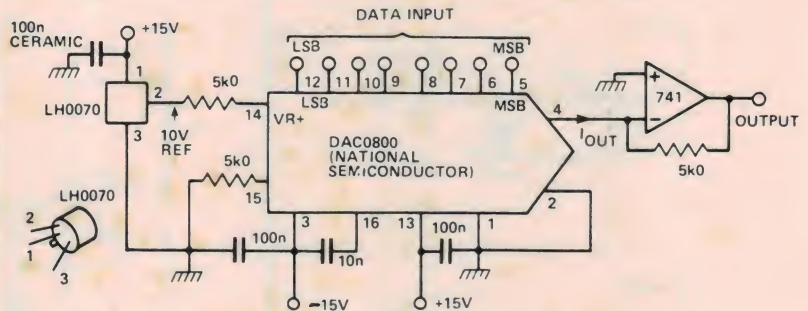


## DIGITAL

### Six-bit DAC — 10-bit Precision

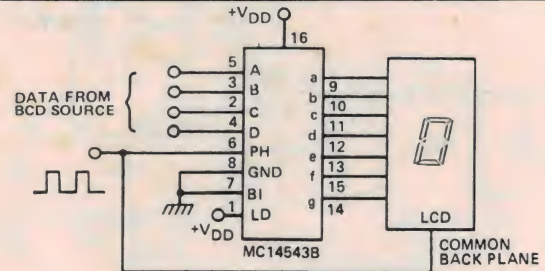


Buffers powered from 0 V and +V<sub>REF</sub>  
Resistors in ladder need 0.1% tolerance  
DAC output has 64 steps



### Standard Eight-bit DAC

The DAC08 is a multiplying digital-to-analogue converter (DAC). The data input selects a number that is multiplied by the input reference current to determine the output current. For accurate results it is therefore necessary to supply the DAC with a reference current. This role is filled by using the LH0070 precision voltage reference and generating a reference current by dropping this voltage across an accurate resistance, the 5k0. If this accuracy is not important or if the LH0070 is difficult to obtain a zener diode or three-terminal voltage regulator could be substituted.



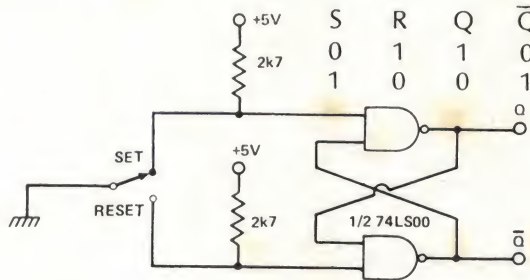
### BCD-to-seven-segment Driver for LCD

The use of liquid crystal seven-segment displays is becoming increasingly popular due to their low power consumption when compared with LED displays. A problem with LCD arises, however, due to its inability to cope with dc drive. The common or backplane must be supplied with a square wave to ensure that the display is not damaged. This circuit provides this function as well as the necessary BCD-to-seven-segment decoding.



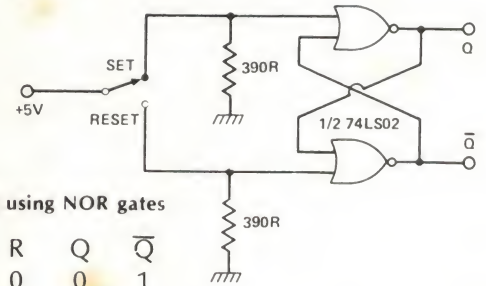
## Debouncing Using Flip-Flops

Flip-flop using NAND gates

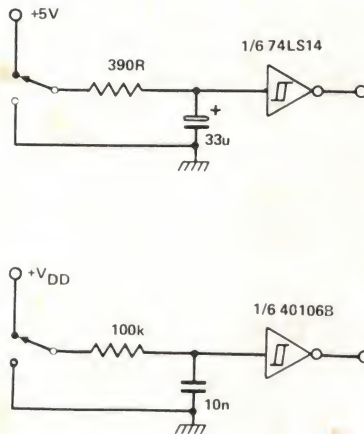
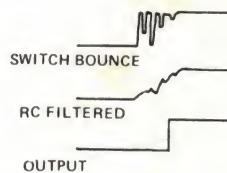


Flip-flop using NOR gates

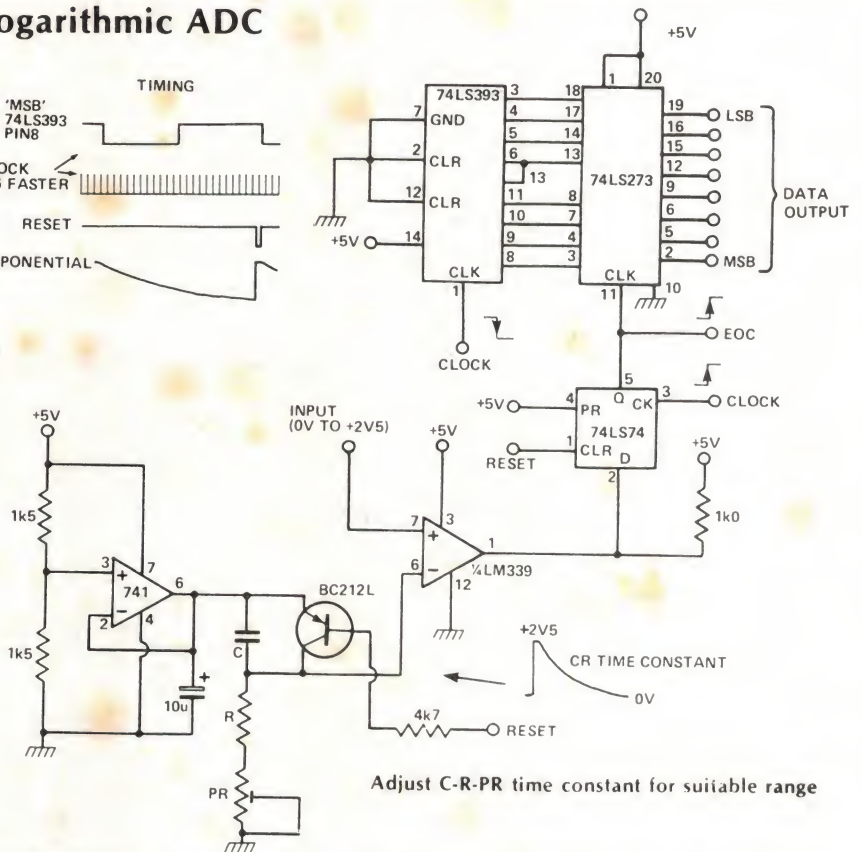
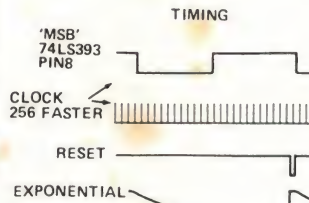
S	R	Q	$\bar{Q}$
1	0	0	1
0	1	1	1



## Debouncing Using Schmitt Triggers

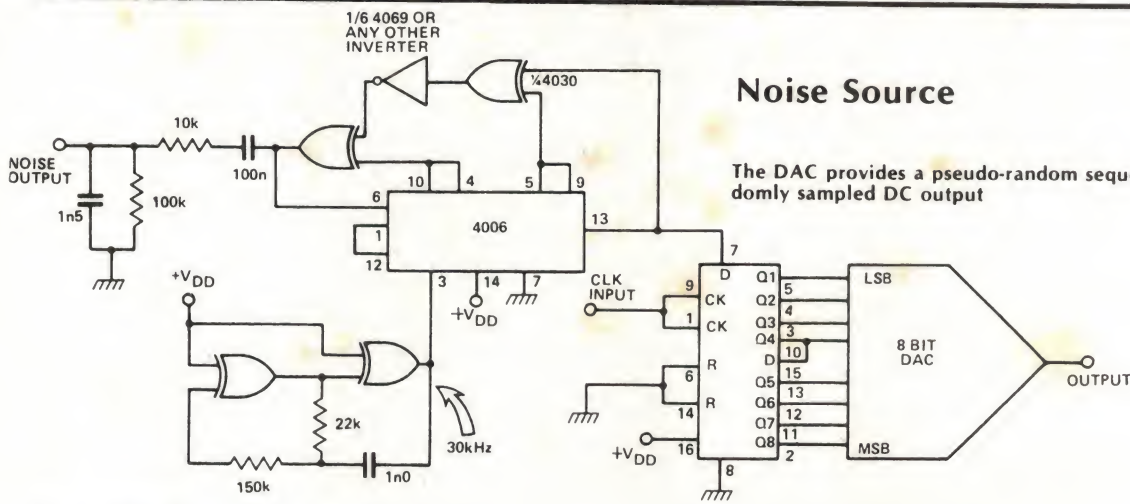


## Logarithmic ADC



## Noise Source

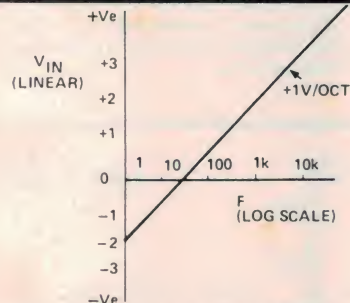
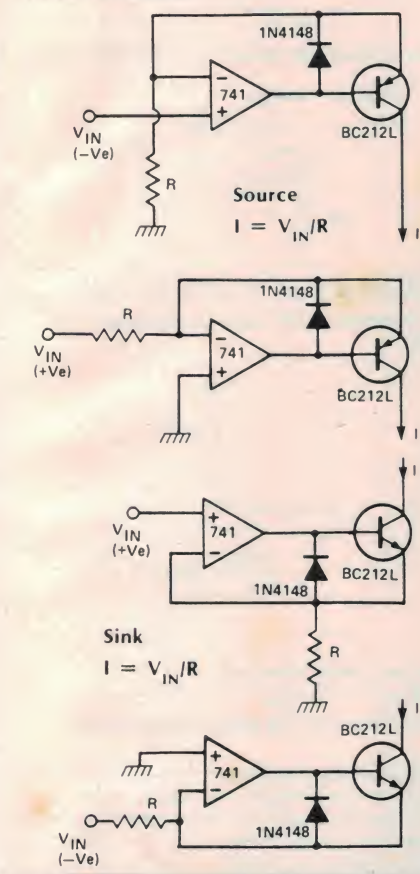
The DAC provides a pseudo-random sequence generator, with a randomly sampled DC output





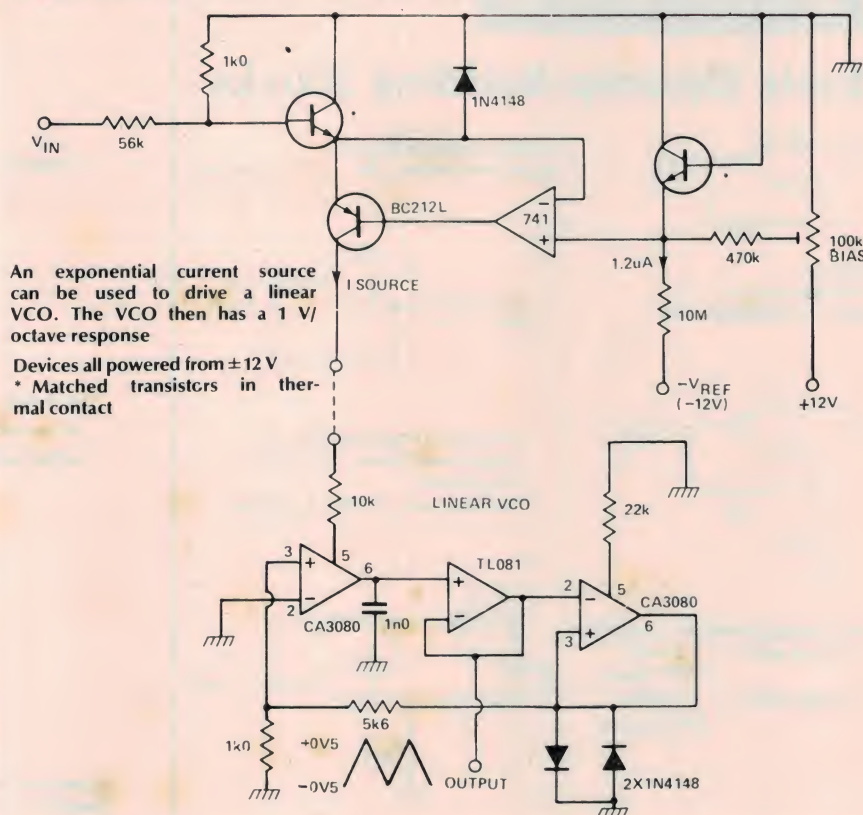
## BUILDING BLOCKS

### Voltage-to-current Converters

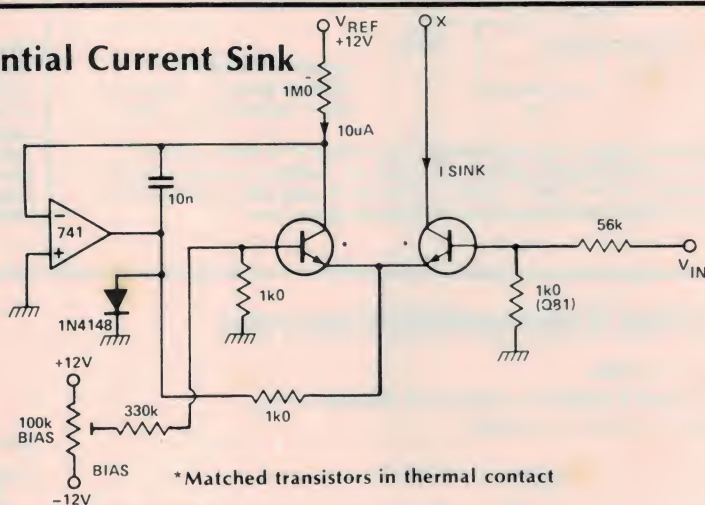


Frequency response of a linear VCO driven by an exponential current sink

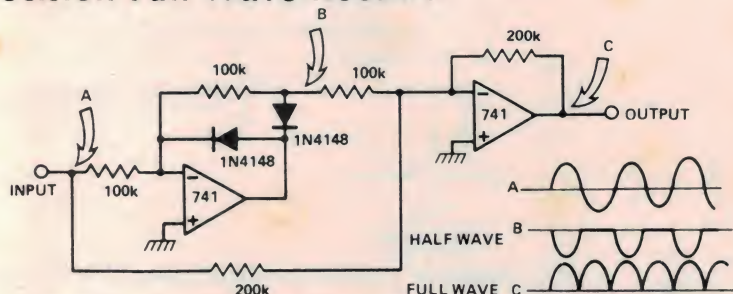
### Exponential Current Source



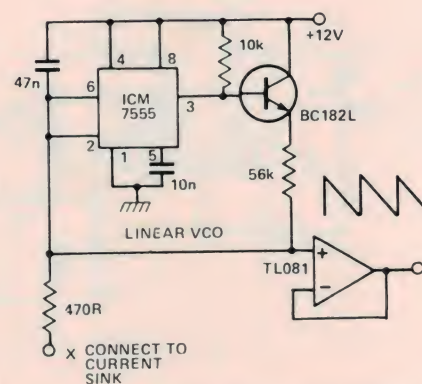
### Exponential Current Sink



### Precision Full Wave Rectifier



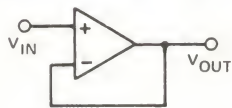
This is a simple full wave rectifier circuit suitable for many applications. The main limitation is due to the speed of the 741. For use above about 10 kHz an alternative op-amp should be used, such as the TL072.





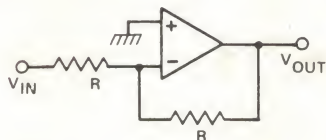
## BUILDING BLOCKS

### Basic Op-amp Building Blocks

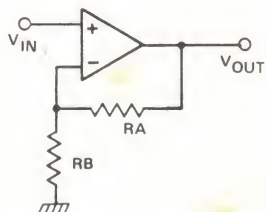


**Voltage follower/buffer**  
Input must have a DC path to ground

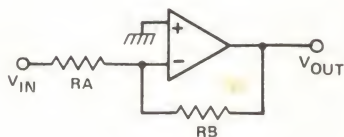
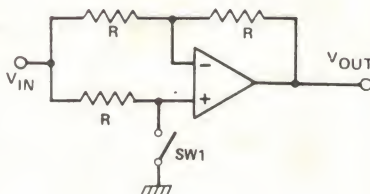
**Inverter**  
Voltage gain =  $-1$   
input impedance =  $R$



**Non-inverting amplifier**  
Input must have a DC path to ground  
Voltage gain =  $(R_A + R_B)/R_P$



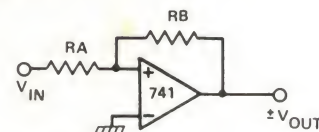
**Inverter/non-inverter amplifier**  
Voltage gain =  $+1$  with SW1 open  
Voltage gain =  $-1$  with SW1 closed



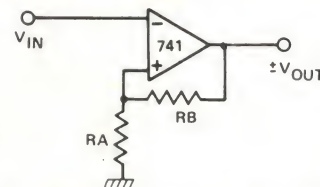
**Inverting Amplifier**  
Voltage gain =  $-R_B/R_A$   
Input impedance =  $R_A$

The power supply and compensation are omitted from these diagrams. If internally compensated devices are used no additional compensation is necessary, i.e: 741, TL071, TL072, TL074, etc. If additional compensation is required consult the data sheets on the particular device used.

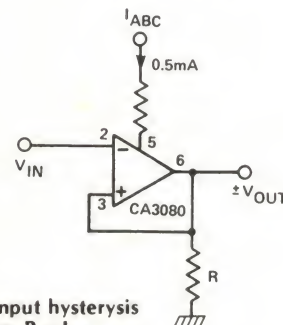
### Schmitt Triggers



**Non-inverting; input hysteresis levels** =  $\pm(R_A/R_B) \times V_{OUT}$



**Inverting; input hysteresis levels** =  $\pm(R_A/(R_A + R_B)) \times V_{OUT}$   
Note that  $V_{OUT}$  depends on the supply voltage and the individual op-amp



**Transconductance type; input hysteresis levels** =  $\pm V_{OUT}$ ;  $V_{OUT} = R \times I_{ABC}$   
 $R$  can be replaced by two 1N4148 diodes back-to-back

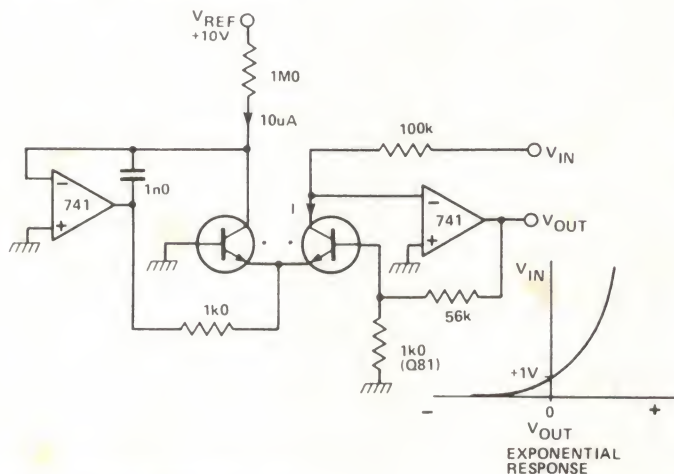
When trying to convert a slowly changing voltage into a step function with a well-defined leading edge a good Schmitt trigger is invaluable. This is a simple but effective trigger capable of good results in the audio passband. Once again, for higher frequency use substitute a faster op-amp for the 741. The Schmitt trigger works by using positive feedback to establish a 'deadband', a range of input voltages within which the output state will not change. The input voltage must exceed the higher limit in order to force the output high. Similarly, the input voltage must be taken below the lower limit to force the output low. The extent of this deadband is given in the equations.

### Antilog (Exponential) Converter

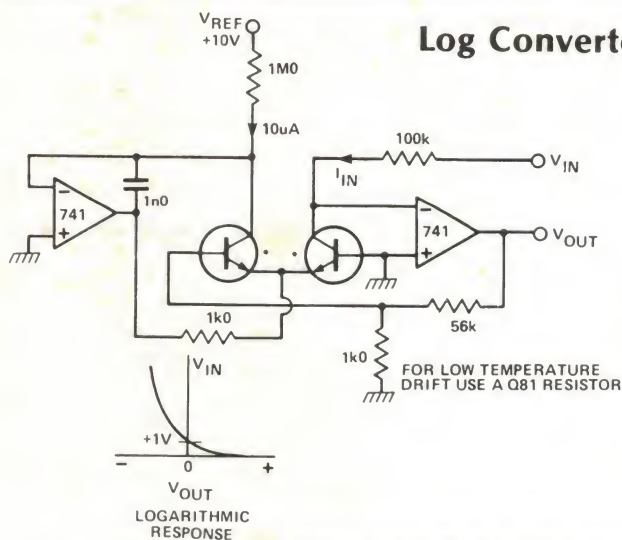
$$V_{OUT} = I \times 100k$$

The current  $I$  doubles for every 1 V increase of  $V_{IN}$

When  $V_{IN} = 0$  V,  $I = 10 \mu A$



### Log Converter



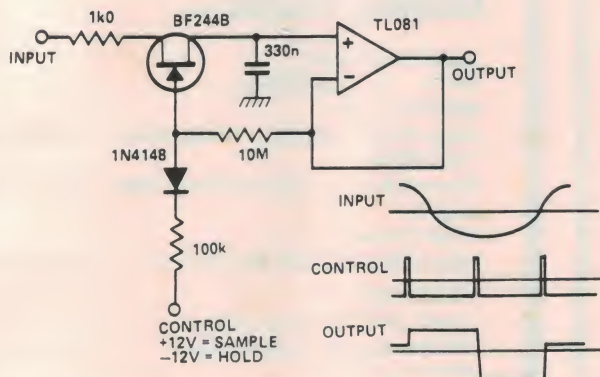
$V_{OUT}$  changes by 1 V for every octave change of the  $I_{IN}$  current

\*The matched transistors can be two BC212L in thermal contact, or a dual transistor (LM394), or part of an array (CA3046)



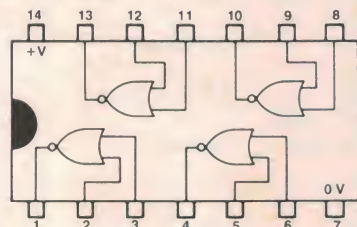
## FET Sample And Hold

Control = +12 V; sample  
Control = -12 V; hold

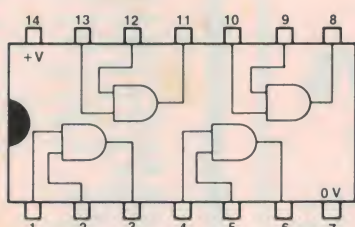


Use a printed circuit guard ring (connected to the output voltage) around the hold capacitor

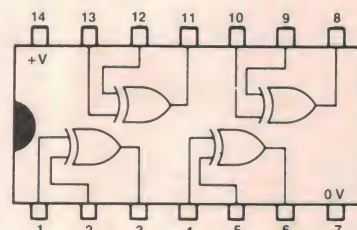
## Pinouts



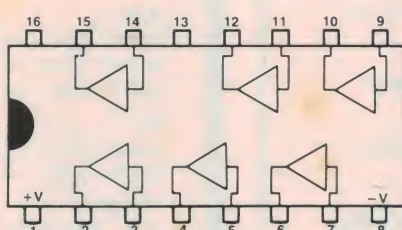
74LS02



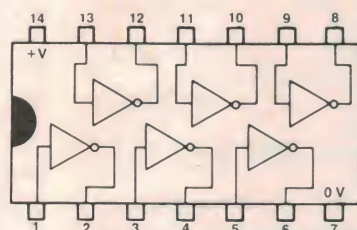
74LS08



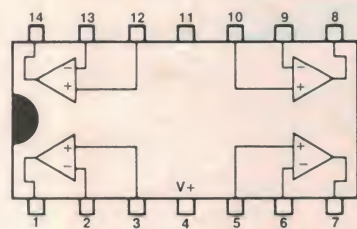
4030



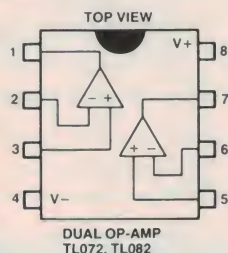
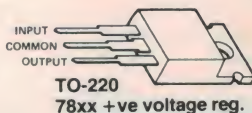
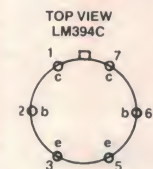
4050



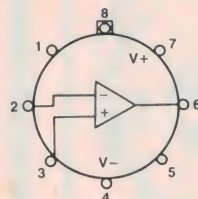
7406 (TTL)  
40106B (CMOS - SCHMITT)  
74LS14 (LS - SCHMITT)  
4069 (CMOS)



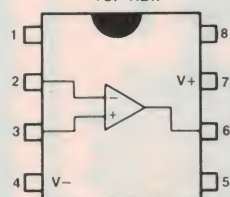
QUAD OP-AMP  
LM324, TL074



OP-AMP  
741, LM108H, LM208H, LM308H, LM301

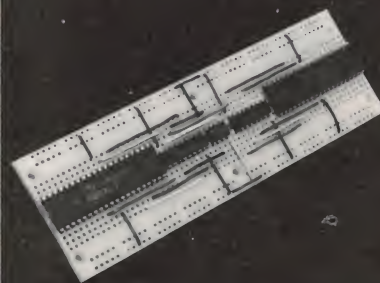


TOP VIEW



OP-AMP  
741, NE5534, TL070, TL071, LM301

## Solderless Breadboarding Sockets



... enable you to insert your electronic components directly — without soldering irons or adapters.

*Go from conception to working circuit in minutes.*

The highest quality socket in the industry now carries a lifetime guarantee. Should the SK 10 ever break, be damaged or fail to perform as described, return it for a free replacement. No questions asked.

We can offer such a guarantee because the SK 10 is a top quality socket built tough for years of use. Integrated circuits and discrete components insert directly without adapters. No patch cords needed. And of course, no soldering.



**ELECTRONIC  
DEVELOPMENT SALES  
PTY LIMITED**

92 CHANDOS STREET, ST. LEONARDS  
P.O. BOX 217 ST. LEONARDS, N.S.W. 2065  
AUSTRALIA

TELEPHONE: 438 2500 438 2412  
TELEX AA 25963

## DISTRIBUTORS

N.S.W.: DGE SYSTEMS

103 Broadmeadow Road, Broadmeadow

Phone: (049) 69 1625

MACLEEC ELECTRONIC

99 Kenny Street, Wollongong 2500

Phone: (042) 29 1455

A.C.T.: ORTEX PTY LTD

5B Cumberland Court, Wollongong Street, Fyshwick 2609

Phone: (062) 82 4995

VIC: STEWART ELECTRONIC COMPONENTS PTY LTD

44 Stafford Street, Huntingdale 3166

Phone: (03) 543 3733

S.A.: GRAPHIC ELECTRONIC INDUSTRIES PTY LTD

41A Rundle Street, Kent Town, 5067

Phone: (08) 42 6655

W.A.: RESERVE ELECTRONICS

5 Bookham Street, Morley 6062

Phone: (09) 275 2377

QLD: FRED HOE & SONS PTY LTD

246 Evans Road, Salisbury North 4107

Phone: (07) 277 4311



# Why pay high prices for cermet

The advantages of Cermet are well known. They are small, robust and totally enclosed. They have low thermal coefficients and high power-dissipation characteristics. They are very stable under wide variations in working conditions.

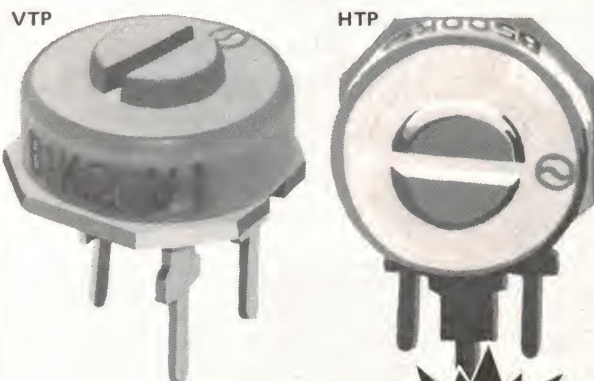
## SOANAR Cermet Trim Potentiometers

Offer you the same advantages but at real down-to-earth prices.

Soanar-Noble VTP/HTP Cermet are available in a range of values from 50Ω to 1 meg and are designed for PCB mounting with vertical or horizontal trim adjustment.

Terminations conform to the standard -1" grid spacing.

Ratings are .5 watts over the temperature Range — 30°C to +80°C



Enclosed, low cost cermet ideal for P.C.B. mounting.

TECHNICAL LITERATURE AVAILABLE ON REQUEST



**SOANAR**

**SOANAR ELECTRONICS PTY.LTD.**

A MEMBER OF THE ARLEC-SOANAR GROUP 30-32 Lexton Road, Box Hill, Vic., 3128, Australia.

VICTORIA: 840 1222  
N.S.W. 789 6733  
Sth. Aust: 42 8918

QUEENSLAND: 52 1131  
WEST. AUST. 381 9522  
TASMANIA: 31 6533

# sinclair ZX81

Available from the following leading stores —

### QUEENSLAND:

MYER — ALL BRANCHES

SOFTWARE 80

Shop 11/200 Mogill Rd., Taringa, 4068 (07) 371 6996

DATACOM

Shop 16, S.G.I.O. Arc. Bundaberg, 4670 (071) 71 4740

A.C.T.:

COMPUTERWORLD

Shop G71, The Bridge, Woden Plaza (062) 81 1368

### TASMANIA:

J. WALSH & SONS PTY. LTD.

130 Macquarie St., Hobart, 7000 (002) 34 7511

BIRCHALLS

118-120 Brisbane St., Launceston, 2250 (003) 31 3011

### VICTORIA:

MYER MELBOURNE, City Store Only

RADIO PARTS GROUP

562 Spencer St., West Melbourne, 3003 (03) 329 7888

ROD IRVING ELECTRONICS

425 High St., Northcote, 3070 (03) 489 8131

MINIT COMPUTER SERVICE

119 McCrae St., Benidigo, 3550 (054) 43 2589

B.B.J. COMPUTER SHOP PTY. LTD.

88 Albert Rd., Sth. Melbourne, 3205 (03) 699 5622

### W.A.:

MICRO BASE

127 Fitzgerald St., Perth, 6000 (09) 329 9308

### S.A.:

MYER ADELAIDE

ACUIS TRADING

185 Pirie St., Adelaide, 5000 (08) 223 1900

### N.T.

ASCOM ELECTRONICS

66 Hartley St., Alice Springs, 5750 (089) 52 1713

### N.S.W.:

B.B.J. COMPUTER SHOP PTY. LTD.

329 Pacific Hwy., Crows Nest, 2065 (02) 922 4022

CITY PERSONAL COMPUTER

75 Castlereagh St., Sydney, 2000 (02) 233 8992

DAVID REID ELECTRONICS PTY. LTD.

127 York St., Sydney, 2000 (02) 29 6601

COMPUTERWAVE PTY. LTD.

Lwr, Ground Floor, Myer, Sydney, 2000 (02) 238 9111

MINIT COMPUTER SERVICE

530 Kiewa St., Albury, 2640 (060) 21 5933

### ORDER FORM: SINCLAIR EQUIPMENT (A'SIA) P/L

86-88 Nicholson St, Abbotsford, Vic. 3067. Ph. 419 3033.

QTY	ITEM	ITEM PRICE	TOTAL
	Ready assembled ZX81 Sinclair Personal Computer including mains adaptor, leads, BASIC manual	\$250	
	16K-BYTE RAM pack	\$150	
	8K-ROM (only required for ZX80)	\$ 75	
	ZX Printer (to be announced)		

I enclose cheque/Bankcard/Diners Club/Amex

Total \_\_\_\_\_

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Name \_\_\_\_\_

Address \_\_\_\_\_ P'code \_\_\_\_\_

Signature \_\_\_\_\_ ETI



# Sinclair

**\$24**  
of software **FREE\***

**finds the  
missing link  
(and goes  
bananas for  
ZX81)**



**\$250** including  
mains adaptor, leads & Basic manual.

**SINCLAIR EQUIPMENT (A/SIA) P/L**  
86-88 Nicholson St., Abbotsford, Vic. 3067.  
Tel. (03) 419 3033

★ Fill in guarantee card, send to Sinclair with receipt of purchase and we will send you a copy of Z Chess cassette free of charge.  
This offer only applies to ZX81 purchased in Australia after 30/1/82. Valid for 1 month only.



# 48 BABANI TITLES

## PRACTICAL-TRANSISTORISED NOVELTIES FOR HI-FI

Circuits for audio power meter, stereo phone adaptor, multi-channel mixers, gain control, contour network etc. etc.

201 \$1.30

## DIODE CHARACTERISTICS, EQUIVALENTS & SUBSTITUTES

Includes signal, zener, rectifier diodes etc. Full interchangeability data and characteristics of thousands of diodes of all types with every possible alternative. Includes UK, USA, European, Russian and Far Eastern devices.

211 \$4.20

## AUDIO ENTHUSIAST'S HANDBOOK

Discusses audio and hi-fi topics including record/playback curves, stylus compliance, disc recordings — then and now, evaluating loudness, equipment compatibility, acoustic feedback, equipment performance figures and standards etc. etc.

214 \$2.90

## SHORTWAVE CIRCUITS & GEAR FOR EXPERIMENTERS & RADIO HAMS

This practical little book covers a whole variety of useful items of equipment of interest to the hobbyist interested in shortwave radio, TV, FM, amateur radio, etc. All coil and component data is included and parts are generally locally available, so constructors should have little difficulty in building projects from this book. Antennas are covered also.

215 \$2.90

## BUILD YOUR OWN ELECTRONIC EXPERIMENTER'S LAB USING ICs.

Includes many circuits and designs for constructing test and measuring instruments mostly using modern ICs. Includes AF osc, TTL pulse detector, hi-impedance Vm, square-wave osc/pulse gen, logic probe, lo-range ohmmeter, bridge, signal tracer etc.

218 \$2.90

## SOLID STATE NOVELTY PROJECTS

A number of novelty projects using modern ICs and transistors. Includes 'Optomin' — a musical instrument played by reflecting a light beam with your hand, water warbler for pot plants, music tone generator, LEDs and ladders game, touch switch electronic roulette wheel, etc.

219 \$2.90

## 28 TESTED TRANSISTOR PROJECTS

Some circuits are new, others are familiar designs. Projects can be split and/or combined for specialised needs.

221 \$4.20

## 50 PROJECTS USING CA 3130 ICs.

The CA3130 is an advanced operational amplifier capable of higher performance than many others: circuits often need fewer ancillary components. Interesting and useful projects in five groups. Audio projects. RF projects. Test equipment. Household projects. Misc. projects.

223 \$4.20

## 50 CMOS IC PROJECTS

Many interesting and useful projects — multivibrators, amplifiers and oscillators; trigger devices; special devices.

224 \$4.20

## PRACTICAL INTRO TO DIGITAL ICs

Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

225 \$4.20

## ESSENTIAL THEORY FOR THE ELECTRONICS HOBBYIST

This book supplies hobbyists with background knowledge, tailored for his or her specific requirements and presented in a readable manner with minimum maths. Purpose-designed examples illustrate applications.

228 \$4.20

## HANDBOOK OF RADIO, TV, INDUSTRIAL & TRANSMITTING TUBE & VALVE EQUIVALENTS

Equivalents book for amateurs and servicemen. More than 18 000 old and new valves from UK, USA, Europe, Japan et al. CV (military) listings with commercial equivalents included.

BP2 \$2.25

## COLOUR CODE & DATA CHART

A very useful wall chart containing resistor and capacitor colour codes and how to read them, audio connector colour codes, transformer wires colour codes, battery cord colour codes. PLUS — charts and formulae for resistors, capacitors and inductors in parallel and series; resistor power ratings chart. 50/75 ohm attenuator tables and more . . .

BP7 \$1.50

## FIRST BOOK OF PRACTICAL ELECTRONIC PROJECTS

Full constructional data, circuits, components lists for many practical projects including audio distortion meter, super FET receiver, guitar amp, metronome, etc.

BP23 \$2.55

## 52 PROJECTS USING IC 741

A must for those interested in any way in this inexpensive and versatile IC. European best seller!

BP24 \$3.20

## GIANT CHART — RADIO, ELECTRONICS, SEMI-CONDUCTOR & LOGIC SYMBOLS

Identify those symbols at a glance. A must for beginners and advanced enthusiasts alike. Professionals can always hide it in their desks! A steal at only . . .

BP27 \$2.20

## ELECTRONIC CALCULATOR USERS' HANDBOOK

Invaluable for all calculator users. Presents formulae, data, methods of calculation, conversion factors etc. often with examples. Includes way to use simple calculator for trig functions (sin, cos, tan); hyperbolic functions (sinh, cosh, tanh); logs; square roots; and powers.

BP33 \$4.20

## FUN AND GAMES WITH YOUR CALCULATOR

Amazing collection of 101 jokes and riddles, several quite mind-boggling games for two or more players and a dictionary of numbers which are words if the calc. is read upside down.

BP38 \$2.50

## DIGITAL ICs & PIN CONNECTIONS

Equivalents and pin connections of popular user-orientated digital ICs. Details of packaging, families, functions, manufacturer, and countries of origin. Includes Fairchild, Ferranti, Harris, ITT, Motorola, National, Phillips, RCA, Signetics, Sescocem, SGS-Ates, Siemens, SSSI, Stewart Warner, AEG-Telefunken, Texas, Tele-dyne. Companion volume to BP41.

BP40 \$8.45

## LINEAR IC EQUIVALENTS & PIN CONNECTIONS

Similar to BP 40 but deals with linear ICs.

BP41 \$9.25

## 50 SIMPLE LED CIRCUITS

50 interesting and useful circuits and applications using LEDs. A useful book for beginner and advanced enthusiast alike.

BP42 \$3.20

## MOBILE DISCO HANDBOOK

Most people who start mobile discos know little about equipment or what to buy. This book assumes no preliminary knowledge and gives enough info to enable you to have a reasonable understanding of disco gear.

BP47 \$4.55

## ELECTRONIC PROJECTS FOR BEGINNERS

This book gives the newcomer to electronics a wide range of easily built projects. Actual components and wiring layouts aid the beginner. Some of the projects may be built without using soldering techniques.

BP48 \$4.55

## POPULAR ELECTRONIC PROJECTS

A collection of the most popular types of circuits and projects covering radio, audio, household and test equipment.

BP49 \$4.90

## LM 3900 IC PROJECTS

Unlike conventional co-amps, the LM 3900 can be used for all the usual applications as well as many new ones. It's one of the most versatile, freely obtainable and inexpensive devices around. This book provides the groundwork for simple and advanced uses — it's much more than a collection of projects. Very thoroughly recommended.

BP50 \$4.55

## YOUR CALCULATOR & YOUR MONEY

How to get the most out of your calculator — in particular calculating mortgages, car costs, insurance, fuel, shopping, gambling, income tax etc. Also includes interest rates, savings, shares plus the use of a calculator in small businesses. This book could save you hundreds of \$\$\$\$\$\$.

BP54 \$4.55

## RADIO STATIONS GUIDE

Eight sections covering: European LW/AM; European, Near East and N. African MW/AM; World-wide SW/AM; European FM/VHF; Broadcast band USA; Broadcast band Canada; Local UK; Wavelength/frequency conversion. Book shows station site, country, frequency, wavelength, effective radiated power and, in some cases, call sign.

BP55 \$5.90

## 50 CIRCUITS USING 7400 SERIES ICs

7400 ICs are freely obtainable, inexpensive and very versatile. Here's 50 interesting and useful circuits using this IC.

BP58 \$4.55



# -direct to you by mail

## SECOND BOOK OF CMOS IC PROJECTS

Leading on from book number 224 '50 CMOS IC PROJECTS', this second book provides a further selection of useful circuits mainly of a fairly simple nature. Contents have been selected to ensure minimum overlap between the two books.

**BP59** \$5.05

## BEGINNER'S GUIDE TO DIGITAL ELECTRONICS

Covers all essential areas including number systems, codes, constructional and sequential logic, analog/digital/analog conversion.

**BP61** \$3.20

## SINGLE IC PROJECTS

Simple to build projects based on a single IC. A few projects use one or two transistors as well. A strip board layout is given for each project plus special constructional and setting up info. Contents include low level audio circuits, audio power amps, timers, op-amps and miscellaneous circuits.

**BP65** \$5.05

## BEGINNER'S GUIDE TO MICROPROCESSORS & COMPUTING

Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

**BP66** \$5.90

## COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS

Well-known author F.G. Rayer features applications and projects using various types of numeral displays, popular counter and driver ICs, etc.

**BP67** \$5.90

## CHOOSING AND USING YOUR HI-FI

Provides fundamental info invaluable when buying hi-fi. Explains tech, specs, and advice on minimum acceptable standards and specs for adequate sound. Also invaluable advice on how to buy and install and maximise your equipment's includes glossary of terms.

**BP68** \$5.55

## ELECTRONIC GAMES

How to build many interesting electronic games using modern ICs. Covers both simple and complex circuits for beginner and advanced builder alike. Good one!

**BP69** \$5.90

## ELECTRONIC HOUSEHOLD PROJECTS

Most useful and popular projects for use around the home. Includes two-tone buzzer, intercom, smoke and gas detectors, baby alarm, freezer alarm etc. etc.

**BP71** \$5.90

## A MICROPROCESSOR PRIMER

This small book takes the mystery out of microprocessors. It starts with a design for a simple computer described in language easy to learn and follow. The shortcomings of this basic machine are then discussed and the reader is shown how these are overcome by changes to the instruction set. Relative addressing, index registers follow as logical progressions.

An interesting and unusual approach.

**BP72** \$5.90

## ELECTRONIC MUSIC PROJECTS

Provides constructors with practical circuits for the less complex music equipments including fuzz box, waa-waa pedal, sustain unit, reverb and phaser, tremolo etc. Text covers guitar effects, general effects, sound generators, accessories.

**BP74** \$5.90

## ELECTRONIC TEST EQUIPMENT CONSTRUCTION

Describes construction of wide range of test gear including FET amplified voltmeter, resistance bridge, field strength indicator, heterodyne frequency meter etc.

**BP75** \$5.90

## PRACTICAL COMPUTER EXPERIMENTS

How to build typical computer circuits using discrete logic. This book is a useful intro to devices such as adders and storers as well as a general source book of logic circuits.

**BP78** \$5.90

## RADIO CONTROL FOR BEGINNERS

How complete systems work with constructional details of solid state transmitters and receivers. Also included — antennas, field strength meter, crystal controlled superhet, electro-mechanical controls. Ideal for beginners. Section dealing with licensing etc. not applicable to Australia.

**BP79** \$5.90

## POPULAR ELECTRONIC CIRCUITS — BOOK 1

Yet more circuits from Mr Penfold! Includes audio, radio, test gear, music projects, household projects and many more. An extremely useful book for all hobbyists offering remarkable value for the designs it contains.

**BP80** \$6.60

## ELECTRONIC PROJECTS USING SOLAR CELLS

Well-known author Owen Bishop has designed a number of projects that benefit from solar power and obviate the problems encountered with batteries, such as weight and bulk, frequency of replacement, and failure when batteries are exhausted.

**BP82** \$7.15

## VMOS PROJECTS

A book to suit the dyed-in-the-wool experimenter. Though primarily concerned with VMOS power FETs and their applications, power MOSFETs are dealt with, too, in a chapter on audio circuits. A number of varied and interesting projects is covered under the headings: Audio Circuits, Sound Generator Circuits, DC Control Circuits and Signal Control Circuits. Learn while you build.

**BP83** \$6.40

## DIGITAL IC PROJECTS

Companion to No. 225 Practical Introduction to Digital ICs and BP61 Beginner's Guide to Digital Electronics. The projects included in this book range from simple to more advanced projects — some board layouts and wiring diagrams are included. The more ambitious projects have been designed to be built and tested section by section to help the constructor avoid or correct any faults that may occur.

**BP84** \$6.40

## INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE

Companion to BP1 and BP14 equivalents books, but contains a huge amount of information on modern transistors produced by over 100 manufacturers. Wherever possible, equivalents are subdivided into European, American and Japanese types. Also shown are the material type, polarity, manufacturer and indication of use or application.

**BP85** \$9.95

## AN INTRO TO BASIC PROGRAMMING TECHNIQUES

Ideal for beginners seeking to understand and program in BASIC. Book includes program library for biorhythms, graphing Y against X, standard deviations, regressions, generating musical note sequences, and a card game.

**BP86** \$6.60

## SIMPLE LED CIRCUITS — BOOK 2

Sequel to BP42. Further light-emitting diode circuits. If you liked BP42 you'll love this one. If you don't know either it's well worth buying both!

**BP87** \$5.05

## ORDER FORM

Please forward

Book	Qty.		
		BP24	...
		BP27	...
		BP33	...
201	...	BP38	...
211	...	BP40	...
214	...	BP41	...
215	...	BP42	...
218	...	BP47	...
219	...	BP48	...
221	...	BP49	...
223	...	BP50	...
224	...	BP54	...
225	...	BP55	...
228	...	BP58	...
BP2	...	BP59	...
BP7	...	BP61	...
BP23	...	BP65	...
		BP66	...
		BP67	...
		BP68	...
		BP69	...
		BP71	...
		BP72	...
		BP74	...
		BP75	...
		BP78	...
		BP79	...
		BP80	...
		BP82	...
		BP83	...
		BP84	...
		BP85	...
		BP86	...
		BP87	...

Send to ETI Book Sales, 4th Floor,  
15 Boundary St, Rushcutters Bay NSW 2011.  
Please allow 4-5 weeks for delivery. Trade enquiries welcomed

Post & handling:

1 - 4 books: \$1.35      11 - 20 books: \$3.50  
5 - 10 books: \$2.70      over 20 books: \$5.00

I enclose \$ ..... (inc. p & h.)

Name .....

Address .....

.....

..... Postcode .....



Bill Edge's

# ELECTRONIC AGENCIES

115-117 Parramatta Road Concord 2137  
(Corner Parramatta Rd & Lloyd George Ave)  
Telephone (02) 745 3077 (two lines)

**bankcard**  
welcome here

TRADING HOURS  
Mon-Fri 8.30am-5.30pm  
Thursday 8.30am-9.00pm  
Saturday 8.30am-noon  
Sunday 10am-2pm

Mail Orders:  
PO Box 185  
Concord  
2137

MAIL CHARGES

\$5-\$9.99 ..... \$1.00  
\$10-\$24.99 ..... \$2.00  
\$25-\$49.99 ..... \$3.00  
\$50-\$99.99 ..... \$4.00  
\$100 or more ..... \$5.00

115 heavy or bulky items (over 20kg) sent Comet Road Freight anywhere in Australia.  
All heavy or bulky items (over 20kg) sent Comet Road Freight anywhere in Australia.  
All prices correct and goods in stock at time of going to press. Please phone to check current availability.

TEST EQUIPMENT

SEMICONDUCTORS

COMPONENTS

## FIVE SPEAKER BARGAINS FROM THE KIT SPECIALISTS!

### PEERLESS

#### PAS100 3 way 100 litre

High power, high performance speaker systems by Electronics Australia. Power handling of 100 watts makes it ideal for today's high powered amplifiers. Features 305mm bass driver, 50mm dome midrange and a 25mm cloth dome tweeter.

Enclosure kit is sold separately:  
Cat. CE2465 Fully built \$229.00 pair  
Complete kit including all drivers and crossovers for a pair of speakers. Cat. CE2422

**\$379**

#### PAS60 3 way 60 litre

Power handling of 60 watts, 250mm bass, 75mm midrange and 25mm soft dome tweeter. Kit complete with all drivers, crossovers and instructions to build a pair of speakers. Cabinets are not included. Cat. CE2424

**\$225**

**PAS25 2 way 25 litre** The baby of the Peerless range - but still a top performer. Ideal for small rooms, the PAS25 can handle up to 50 watts with its 210mm bass driver and 25mm dome tweeter. Kit includes all parts and instructions (except cabinets).

**\$179**

### ETI 4000

#### 4000/1 4 way

The build it yourself speaker system that beats most commercial units: that's the ETI 4 way. Based on proven Philips drivers, with a superb crossover and cabinet design by ETI, these speakers will do any system justice. Ideal mates for the ETI5000 amp/preamp (see below). Kit includes all drivers and crossover components Cat. CE2430.

Cabinets: Cat. CE2470 \$250 pair fully built. Note: no sales tax price rise!

**STILL ONLY \$499 A PAIR!**

#### 3 way

Smaller than the 4 way, but the same high performance. All Philips drivers, high performance crossover. Kit includes everything you need (except cabinets). Cat. CE2440. Cabinets available separately. Cat. CE2480 \$210 pair - fully built

**STILL ONLY \$380 pair**

## KITS ★ KITS ★ KITS ★ KITS ★ KITS ★ KITS

### ETI 660 COMPUTER

The great new super-economy computer kit from ETI. Ideal for the beginning computer buff. Basic kit is just \$99, and you can add options as you need them. On demonstration in our store.

Cat. KE6600 Basic kit \$99.00  
Cat. KE6602 Colour option \$13.50  
Cat. KE6603 Video mod. in box \$14.50  
Cat. ME7712 Plugpack to suit \$11.95  
Cat. ZE6114 3K upgrade (4x2114) \$17.00  
Cat. KE6601 18 keys & labels \$32.00  
Cat. BE7100 COSMAC Users' Guide \$5.00  
Cat. KE6605 RCA touch keyboard with conversion kit, cable & plug \$113.00  
(Stocks expected, phone first)

### NEW WIND DIRECTION INDICATOR

This is an add on for the Wind Speed Indicator kit, also from EA, which gives you a full remote indication of wind direction as well as speed. Complete kit includes new front panel and all additional parts, but must be used with the Wind Speed Indicator kit below.

Cat. KE1631 **\$25.00**

### WIND SPEED INDICATOR

The companion to the above wind direction indicator, also from EA. Operates on optical principle so moving parts are kept to a minimum. Complete kit of parts - note that some mechanical assembly is required for this kit. Cat. KE1630

**\$44.50**

### EPROM Programmer

As published in Jan 82 EA. Programs all popular EPROMs. Don't mess about with cassettes for your frequently used programs. Cat. KE1880.

**\$52.50**

### 5000

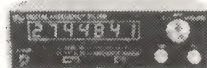
**PREAMP \$245**

### METRONOME

Keep it in time with this new kit. As described in EA Jan 82. Full range of tempos - get that rhythm! Cat. KE1065

**\$17.50**

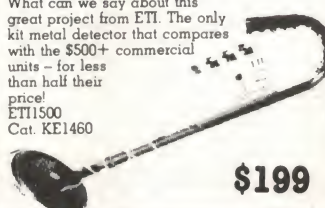
### 50MHz FOR \$119!



EA's new improved frequency counter (see December 81). Absolutely complete kit as specified. Measures up to 50MHz • 7 digits • Period measurement • variable period and gating times • leading zero suppression. Cat. KE1810 Only \$119.00. Cat. KE1815 500MHz conversion \$25.00

### STRIKE IT RICH!

What can we say about this great project from ETI. The only kit metal detector that compares with the \$500+ commercial units - for less than half their price! ETI1500 Cat. KE1460

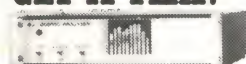


**\$199**

**POWER AMP \$295**

The power amp to match the ETI5000 preamp. 100W per channel, FET output, deluxe heatsink/front panel. Kit comes complete with specially made case - not a primitive 'bits and pieces' case and a specially finished front panel at no extra charge. Cat. KE5050

### GET IT FLAT!



A flat frequency response is essential for good sound - right? Here's the only way to tell whether the response really is flat - a graphic analyser. Comparable with commercial units costing hundreds of dollars more, this kit by EA is a must for the audiophile. Complete kit with Horwood case, all parts and instructions. Cat. KE4150 **\$119**

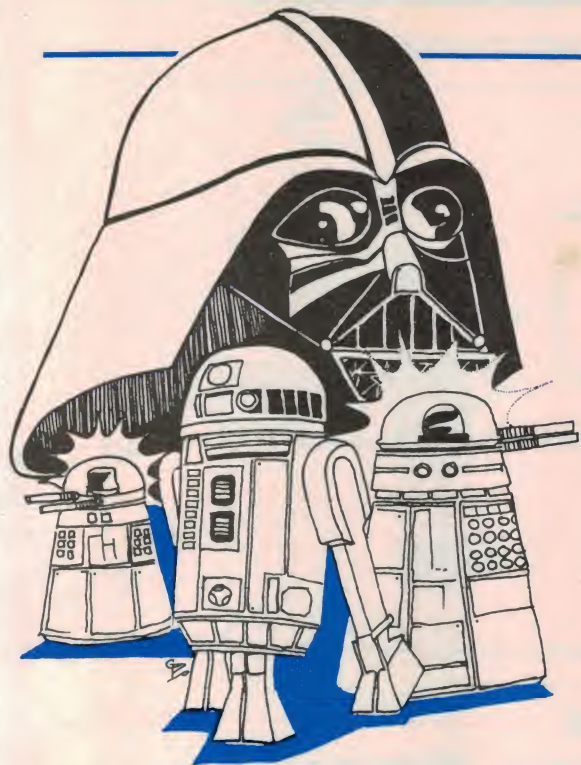
### TIME IT!

EA's electronic update on the traditional 'egg timer'. Solid state 'sand' gives you a perfect egg every time! Build one of these for the 'person who has everything'. Great conversation piece. Cat. KE1027

**\$23.50**

Glover & Assoc





# Tremolo to See-Threepio, Darth Vader to Daleks

## — all from our Sound Bender!

Based on a remarkably versatile function generator IC, the XR2206, this project is capable of modifying an audio signal to produce tremolo effects on music or those peculiar, metallic robot voices so abundantly found in shows like 'Dr Who', 'Star Wars', 'Star Trek', etc.

**Design: Ray Marston**

**Development: Roger Harrison**

'VARIETY is the spice of life' goes a famous old saying, and when electronics entered the musical arena, engineers and musicians sought ways of extending the variety of available musical sounds, some by developing electronic 'instruments', others by developing circuits that modified the sound produced by the voice or an instrument. Deliberately introducing plain old distortion gave rise to the 'fuzz box', amplitude modulating the sound gave a 'tremolo' effect, etc.

Now, a device developed to permit more conversations per line on the telephone system was discovered to produce a range of 'intelligible', but highly modified, sounds from voice and music signals. Called variously a 'ring modulator' or 'four-quadrant multiplier', it is achieved by mixing an audio signal with an oscillator signal, and the output is the product of these two signals, con-

taining both sum and difference frequencies. The oscillator or 'carrier' signal is reduced or suppressed. If, for example, the carrier frequency is 1 MHz and the audio signal is speech with a range of around 150 Hz to 3 kHz, the ring modulator's output would be two 'sidebands' — a 'lower' one (the difference) at 997 kHz to 999.85 kHz and an 'upper' one (the sum) at 1000.15 kHz to 1003 kHz. The 1 MHz carrier level could be 20 dB to over 40 dB lower in level than the sidebands, depending on how 'good' the ring modulator is. If the carrier is set at 1 kHz, though, the sum and difference frequencies at the output spread up and down the audio spectrum, and if speech is the input you get a jumble of voice sounds, some shifted up in frequency, some inverted and apparently shifted down in frequency. The best examples we can cite are the voices of Darth Vader from 'Star Wars', the

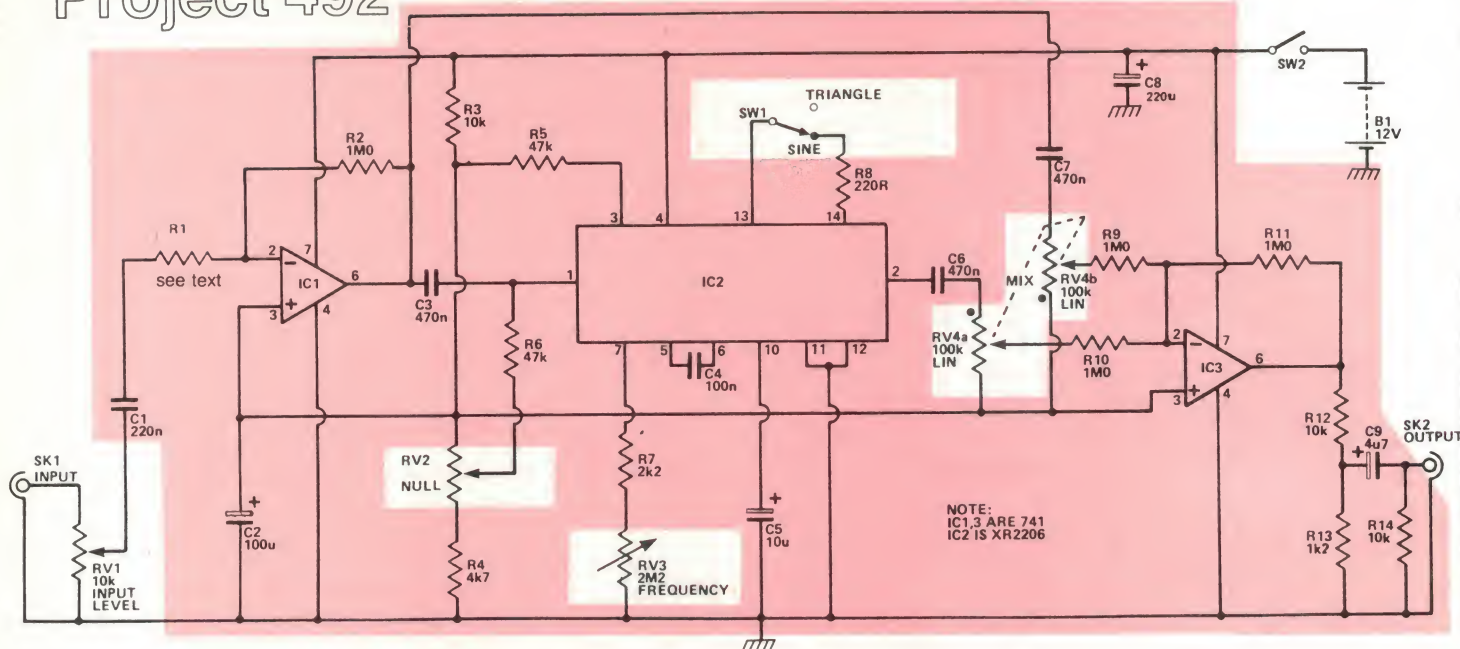
Daleks from 'Dr Who' and the Cylons from 'Star Trek'. If the carrier is placed at a sub-audible frequency, then the result is a tremolo effect, where the audio signal is seemingly amplitude modulated at a slow rate.

The XR2206 function generator IC contains a voltage-controlled oscillator and a four-quadrant multiplier or ring modulator, so in one chip we have both the carrier oscillator and the modulator that can be combined in a circuit to produce the effects we seek. As the panel on page 40 shows, which explains the XR2206 and typical applications, the IC also includes internal control and signal shaping circuitry, making the circuit design job a whole lot simpler.

This project is designed to make full use of the functions incorporated in the XR2206 for this application, and the IC's VCO — used here as the carrier ►



# Project 492



## HOW IT WORKS — ETI 492

By mixing or 'multiplying' an audio signal with an oscillator or 'carrier' signal that may be varied from the sub-audible to the mid-range of the audio spectrum, the original signal may be altered in a variety of ways. Mixing an audio signal with a sub-audible carrier produces a tremolo effect — a form of amplitude modulation; mixing speech with a carrier around 1 kHz to 2 kHz produces 'robot' voices. That's just to name a few of the more familiar effects possible.

The heart of this unit is IC2, an XR2206 function generator chip that incorporates a multiplier — used to perform the modulating function — plus a voltage controlled oscillator (VCO), signal-shaping circuitry, and control circuitry that permits simple variable resistance control of the VCO. The signal-shaping circuitry permits generation of sine or triangle waveforms out of the VCO.

There are three sections to the circuit: the input amplifier (IC1), the mixer/carrier generator (IC2) and the output mixer/buffer (IC3).

The audio input signal enters via SK1 and RV1, the level control. The signal is coupled to the input op-amp IC1, which has a gain of 10 or 100 depending on the choice of value of R1. If R1 is 100k, the gain of this stage is 10, for 10k the gain is 100. The output of IC1 is coupled to the 'AM input' of IC2 and also to the input circuitry of the output buffer/mixer via C7 and RV4b.

In this application, the VCO in the XR2206 can produce either sine or triangle waveforms by means of switching a resistor in or out of circuit with SW1. A triangle waveform contains odd harmonics, which give a 'rough' or 'dirty' sound. A sine wave with little distortion has almost inaudible harmonics and thus sounds 'clean'. This is important, as we shall see

shortly. The frequency of the VCO can be varied over the range from 3 Hz to about 5 kHz by means of RV3, the 'frequency' control. The frequency is determined by the values of C4, R7 and RV3. The AM input of IC2, pin 1, has a dc bias applied to it via R6, the bias voltage being determined by a divider network between the two supply rails consisting of R3, RV2 and R4. RV2 permits variation of the bias so that critical balancing of the XR2206's multiplier can be achieved to 'null out' the carrier signal (from the VCO). This 'null' control is normally adjusted to produce zero output with no audio signal input.

When an audio signal is applied, the multiplier in the XR2206 produces a *double side-band suppressed carrier* output signal. The output is taken from pin 2, via the internal buffer. Let's take a simple case to show what the multiplier does. Say the VCO is set to a frequency of 1 kHz. With the multiplier balanced there is zero output. Now, if a signal at 440 Hz ('A') is applied to pin 1 of the XR2206, the resultant output will be two frequencies: 1440 Hz and 560 Hz (the sum and the difference). Note, no trace of the carrier — this is a result of using a *balanced* mixer or multiplier. Now, say the audio input is 440 Hz (again), and the VCO is set to 5 Hz. The output will be 445 Hz and 435 Hz. Now, as every musician knows, two instruments tuned a few Hertz apart will produce a 'beat' when sounded together. The beat is perceived as an amplitude variation of the sound — if the effect is deliberately obtained, it is called 'tremolo'.

This applies for the case where the carrier is a 'pure' sine wave. If the carrier contains harmonics, then these too will produce sum and difference products when multiplied with the audio input signal and a complex output will result. Thus for a 'clean-sounding' output, switch SW1 to SINE, for a 'dirty-sounding' out-

put, switch SW1 to TRIANGLE.

The output from the multiplier in the XR2206 is taken from pin 2 (from the internal buffer, as mentioned before). It is coupled to RV4a via C6. Now, RV4 is a dual-gang potentiometer with the 'bottom' end of RV4a connected to the 'top' end of RV4b. With RV4 at the fully anticlockwise position, no signal from pin 2 of IC2 is coupled to the input of IC3, while the full output of IC1 is coupled to the input of IC3. With RV4 at the fully clockwise position, the full output from pin 2 of IC2 is coupled to the input of IC3, while none of the output from IC1 is coupled to the input of IC3. Thus by varying RV4 from one extreme to the other you can obtain a varying proportion of 'direct' to 'modulated' signal.

The output from IC3 is passed to SK2 first via an attenuator (R12, R13) that provides a division of 10 so that with the gain of IC1 set at 10 (R1 100k) the project has unity gain. From the attenuator the signal passes to SK2 via C9. R14 provides a dc return for the output circuit. If you wish, R13 may be omitted and R12 replaced by a link.

Capacitor C8 is a supply rail bypass, and capacitor C5 is a bypass for the internal reference of the XR2206. The non-inverting inputs of IC1 and IC3 are biased up to half the supply rail voltage by strapping them to the junction of R3 and RV2. This is done to provide a 'virtual earth' rail for these two ICs, which normally require a dual supply rail, whereas the XR2206 does not. Capacitor C2 serves as a bypass for this virtual earth rail. The multiplier direct output requires tying to the virtual earth rail also, as shown in the XR2206 application notes, and R5 does this. Note that the supply voltage can be anywhere between 9 V and 15 V. The circuit only draws a few milliamps (roughly, between 10 mA and 15 mA or so) and may be readily battery operated.

oscillator — spans a frequency range from 3 Hz to 5 kHz using a single control pot. To 'harden' or 'soften' the effect produced a 'triangle' or 'sine' oscillator waveform can be selected by a switch, and a two-channel mixer with a 'pan' control pot is incorporated on the output so that you can blend the 'direct' to 'mod-

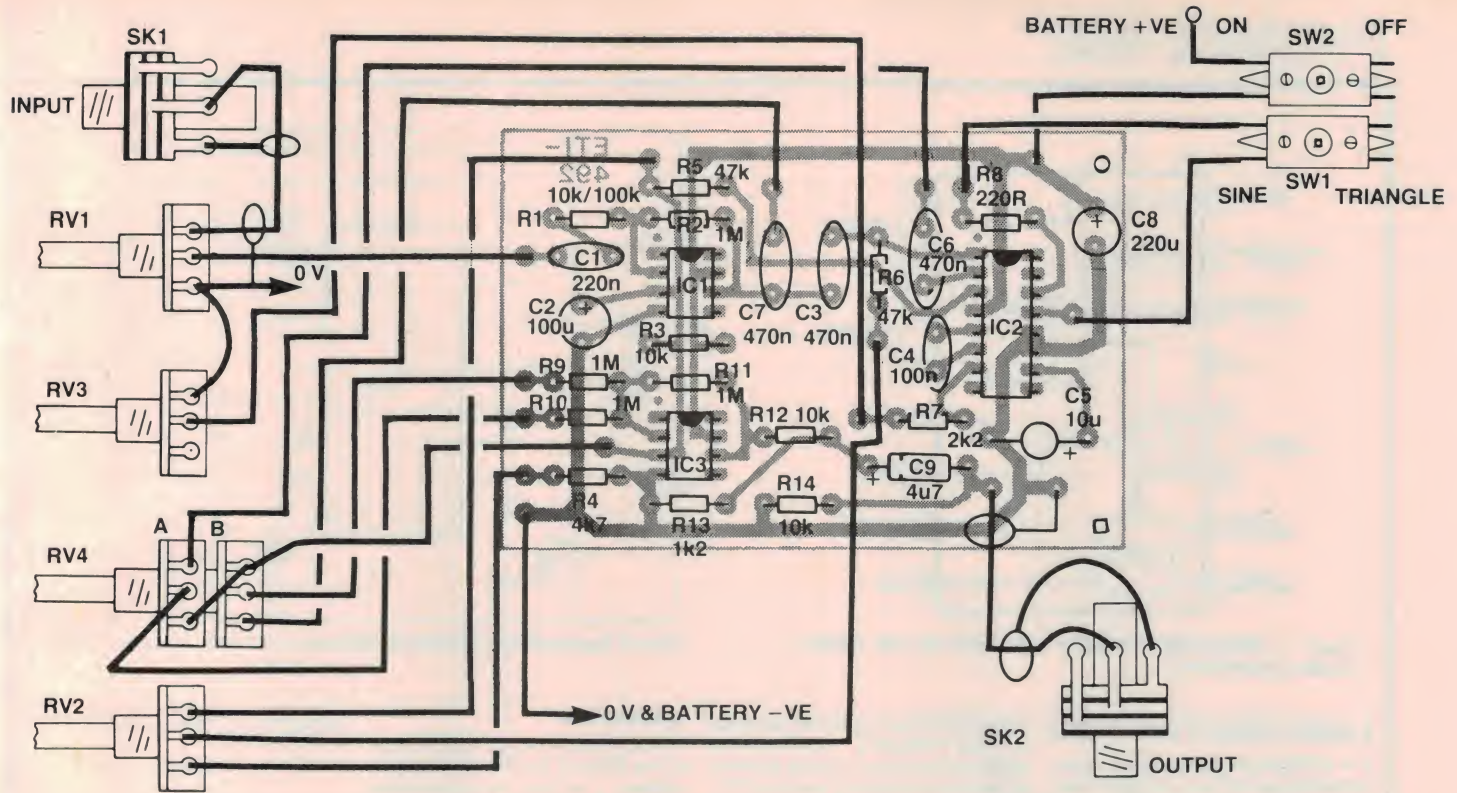
ified' sounds to provide some control over the effect. In addition, a 'null' control has been provided as it is necessary to reduce the level of the carrier signal fed through to the output from the IC's modulator or multiplier.

The project can be operated from input levels as low as a few millivolts (e.g:

microphone) or line levels of 100 mV or greater (e.g: preamp output, such as the 'effects send' on a mixer).

The Sound Bender may be powered from a supply ranging from 9 Vdc to 15 Vdc and draws typically between 10 mA and 15 mA current. A small dc plugpack would make an ideal power supply.





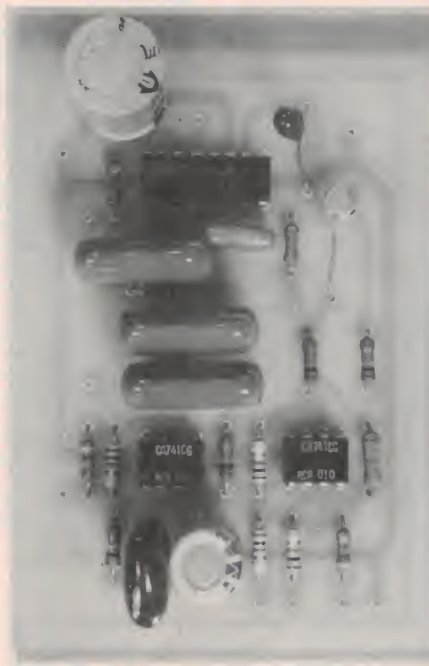
Alternatively, it may be battery operated.

## Construction

We have not described details of a case, front panel, etc, as this project will undoubtedly find a wide variety of uses and we leave it to individual constructors to arrange their own housing. Fortunately, housing is not critical, providing the controls are not mounted too far from the pc board. Leads from the board to the controls should be kept as short as possible, less than 300 mm preferably, as this avoids possible feedback and hum pick-up problems. If the unit is to be mounted in other equipment, keep it away from transformers and mains leads, or thoroughly shield it, again to avoid hum pick-up.

Construction should commence with the pc board. Solder IC1 and IC3 (the two 741s) in place first, taking care that you get them the right way round. They both face in the same direction. Next, insert all the resistors and solder them in place. You'll have to decide at this stage whether you use a 10k or a 100k resistor for R1, as noted with the circuit. The XR2206, IC2, may be inserted next. As it is a CMOS IC, remove it from its packing carefully, taking care only to handle the ends of the pack, not touching the pins. Carefully insert it in the board and solder pin 4 and then 11 and 12. Then solder all the other pins. Take care not to overheat any of the ICs when soldering them in place. Now all the capacitors may be inserted and soldered in place. Watch that you get the orientation of C2, C5, C8 and C9 correct.

Now you're ready to wire up all the



external major components. These can be mounted in any order, to suit yourself, but keep the wiring to RV1 (input level) and RV4 (mix) separated to avoid possible feedback. Use shielded cable where indicated (input and output).

Our overlay and wiring diagram gives an overall guide as to assembly and wiring of the unit.

## Using it

To try out the Sound Bender, connect a supply (battery, plugpack or bench supply — what-have-you) and connect the output to the input of an audio amplifier. We pressed the ETI-453 General

## PARTS LIST ETI-492

Resistors	all ½W, 5%
R1	100k
R2,9,10,11	1M
R3,12,14	10k
R4	4k7
R5,6	47k
R7	2k2
R8	220R
R13	1k2
RV1	10k lin.
RV2	5k lin.
RV3	2M2 lin.
RV4	100k dual lin.
Capacitors	
C1	220n greencap
C2	100u/16 V electro.
C3,6,7	470n greencap
C4	100n ceramic
C5	10u/25 V electro or tant.
C8	220u/16 V electro.
C9	4u7/16 V axial electro.
Semiconductors	
IC1,IC3	741
IC2	XR2206
Miscellaneous	
ETI-492 pc board; two SPDT miniature toggle switches; two phono sockets; case to suit; wire; knobs; nuts and bolts, etc.	

**Price estimate** **\$28 — \$35**

Purpose Amp module (April '80) into service. As we wanted to use a microphone, a 10k resistor was used for R1. Set the Sound Bender's input level to zero, set the mix control fully clockwise, and turn up the audio amp's input gain. SW1 may be set to sine or triangle, it doesn't matter. If you don't hear a whistle, rotate the frequency control until you do. Then vary the null control until you obtain minimum output. This null will be quite sharp so take it slowly. A big knob on the pot shaft or a small vernier would assist. A 10-turn pot here might seem extravagant, but some users may find it useful. ▶



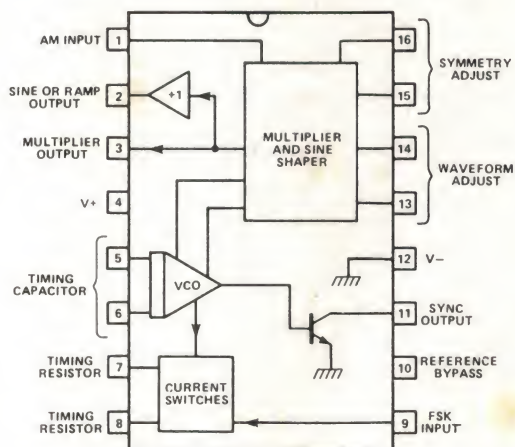


Figure 1. Internal block diagram and pinout for the XR2206 function generator IC.

## A BRIEF LOOK AT THE XR2206

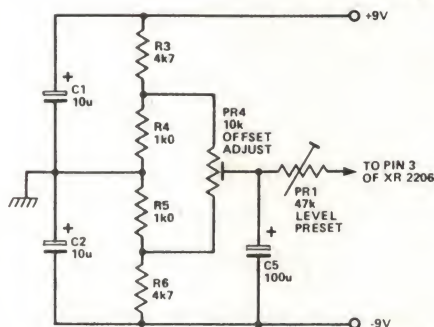
The XR2206 integrated circuit is undoubtedly one of the most useful function generator or waveform generator chips available. It can generate sine, square, triangle, ramp and pulse waveforms at frequencies ranging from a fraction of a Hertz to several hundred kiloHertz, using a minimum of external circuitry. The frequency can be swept over a 2000:1 range using a single control voltage or resistance, and sinewave distortion can typically be as low as 0.5%. The chip incorporates special built-in modulation facilities that enable the generated waveforms to be subjected to AM or FM control, or to phase-shift or frequency-shift keying.

The XR2206 chip is housed in a standard 16-pin DIL package and can be powered from either single or split supplies in the range 10 to 26 V. The sinewave output of the device has maximum amplitude of about 2VRMS and output impedance of 600R. The frequency stability of the IC is excellent, being about 20 ppm/°C for thermal changes and 0.01% V for supply voltage changes.

Figure 1 shows the pinout and internal block diagram.

## WAVEFORM GENERATION

The XR2206 is a reasonably easy IC to use for basic waveform generation. A



**Figure 3. Add-on modification for applying a limited dc offset for output signal dc nulling of the circuit in Figure 2.**

high-performance sine-wave generator is shown in Figure 2. It requires a split supply rail, but total harmonic distortion at the output is typically less than 0.5%. Adjustment of trim pots PR2 and PR3 with a distortion meter connected to the output is necessary, but the THD holds over the frequency range. Trim pot PR1 requires setting for correct operation first, however. Disconnect PR3 (to obtain triangle output), then adjust PR1 until no clipping of the output waveform is visible on a 'scope hung on the output.

Note that the signal appearing on pin 3 of the IC is similar to that on pin 2, but has lower distortion and higher output impedance. Also, the signal on pin 3 is very nearly symmetrical about 0 V but that on pin 2 has an offset of several hundred millivolts. If desired, a slight dc offset may be applied to pin 3 to reduce the offset on the output signal from pin 2 — as shown in Figure 3.

The XR2206 will generate linear triangle waveforms by deleting PR3. A sine/triangle/square wave function generator is shown in Figure 4. Rise and fall times of the square wave output are typically 250 ns and 50 ns respectively, with pin 11 loaded by 10 pF.

C3	FREQUENCY RANGE
1u0	10 Hz TO 100 Hz
100n	100 Hz TO 1 kHz
10n	1 kHz TO 10 kHz
1n0	10 kHz TO 100 kHz

Table 1. Values of C3 for different frequency ranges.

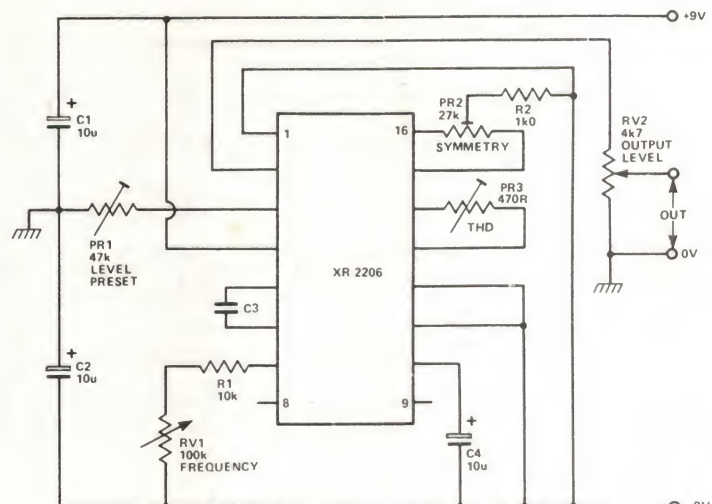


Figure 2. High-performance sinewave generator. See Table 1 for values of C3.

## MODULATION

The amplitude of the pin 2 output signal of the XR2206 can be modulated by applying a dc bias and a modulating signal to pin 1 as shown in Figure 5. The amplitude of the pin 2 signal varies linearly with the applied voltage on pin 1 when this voltage is within 4 V of the half-supply value of the circuit; in split-supply circuits, of course, the half-supply value equals 0 V. When the pin 1 voltage is reduced below the half-supply value the pin 2 signal again rises in direct proportion, but the phase of the output signal is reversed. This last-mentioned phenomenon can be used for phase-shift key (PSK) and suppressed carrier AM generation.

The pin 1 terminal of the IC can also be used to facilitate gate-keying or pulsing of the pin 2 output signal. This can be achieved by biasing pin 1 to near half-supply volts to give zero output at pin 2, and then imposing the gate or pulse signal on pin 1 to raise the pin 2 signal to the desired turn-on amplitude. The total dynamic range of amplitude modulation is 55 dB.

The frequency of oscillation of the XR2206 is proportional to the total tim-

ing current ( $I_T$ ) drawn from pin 7 or 8, and is given by:

$$f = \frac{320 \times I_T}{C} \text{ Hz}$$

where  $I_T$  is in milliamps and  $C$  is in microfarads.

The timing terminals (pins 7 and 8) are low-impedance points and are internally biased at 3 V with respect to pin 12. The frequency varies linearly with  $I_T$  over the current range 1  $\mu$ A to 3 mA. Consequently, the frequency can be voltage-controlled by applying a voltage in the range 0 to +3 V between pin 12 and the timing terminal via a suitable resistor, so that the timing current is determined by the resistor value and the difference between the internal (+3 V) and external (0 to 3 V) voltages. This simple technique can be used to either frequency sweep the generated signals using an externally applied sawtooth waveform, or to frequency-modulate the waveforms with an external signal.

Figure 6 shows the basic method of applying FM to the standard XR2206 circuit. Here, the external modulation signal is applied to the junction of R1-RV1 via blocking capacitor C1.

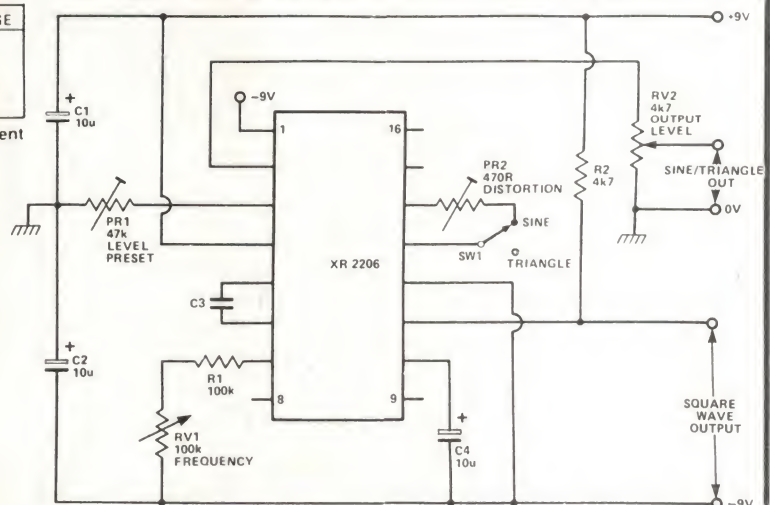


Figure 4. Simple sine/triangle/square wave generator. See Table 1 for values of C3.



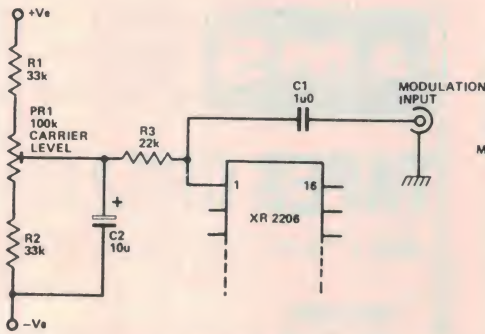


Figure 5. How to add an amplitude modulation (AM) facility (split-supply circuit, as per Figure 2).

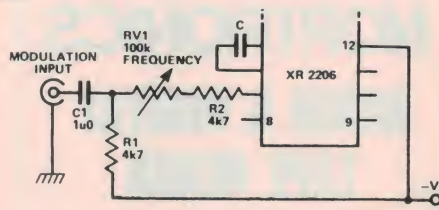


Figure 6. How to add a frequency modulation (FM) facility (split-supply circuit, as per Figure 2).

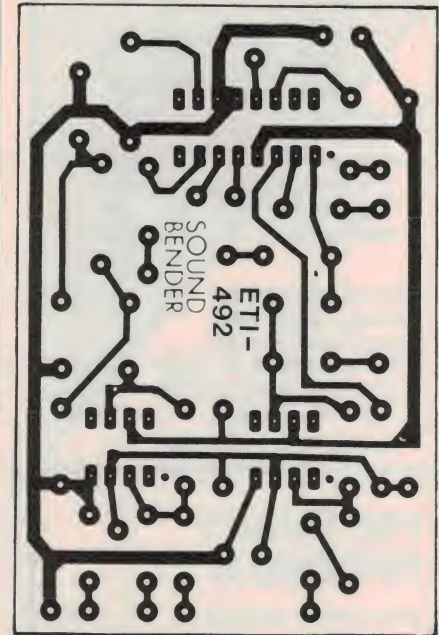
Note that the null is not perfect and there is some carrier feedthrough. However, this can be reduced and the effect-to-carrier leakage ratio improved by judicious adjustment of the mix and input level controls. Keeping the mix control somewhat back from the all-modulated end and the input level up does the trick.

Having nulled the multiplier, plug in a mike or signal source and advance the input level. Set SW1 to triangle for a 'dirty' sound. If the frequency is set to minimum (fully anti-clockwise), you will hear a tremolo effect. Setting the frequency control about two-thirds

advanced you will be able to obtain 'Daleks', 'Darth Vaders', etc, with speech input. With the mix control you can 'fine tune' the effect quite well — we rarely used it fully clockwise (all modulated).

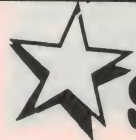
The unit performs best with a 'single signal' input — such as voice or one instrument (such as a guitar). Complex signals, such as from a band or orchestra, end up a confused jumble.

With SW1 set for a sinewave modulating signal, the effect produced is 'soft', while the effect produced when SW1 is set for a triangle wave modulating signal is 'hard'.



We noted that there seems to be some slight delay in the signal through the IC — or the modulator produces a similar effect — and the output sounds a bit 'echoey', especially when the frequency is very low, as on the tremolo effect.

Have fun with your Sound Bender! ●



## SUB-WOOFER SENSATION

Many of you have followed the recent articles in EA regarding the design of vented loudspeaker enclosures. The natural progression of this discussion was a description of a vented speaker system. At the same time we were concerned that the most critical component, the low frequency driver must be of high quality with consistent Q<sub>T</sub> and V<sub>AS</sub>.

Jaycar has had such a speaker made! The unit has been specially manufactured for us to our specs. It is ideal for subwoofer applications based on the work of Thiele, Small and Snyder.

**SPECS: DIAMETER 10" (250mm) CAST FRAME**

Q<sub>T</sub> = 0.39

V<sub>AS</sub> = 63l

POWER HANDLING: 100W (RMS)

VOICE COIL = 2" (51mm) DIA.

MAGNET ASSY. = 3kg (6.6lbs)

Because of bulk buying we have been able to bring this unit to you at an unbelievable price. Normally this unit would sell for well over \$100 (they are overseas).

THE INTRODUCTORY PRICE FOR THIS UNIT?

ONLY \$79.50

A FREE SUBWOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!

# ONLY \$79.50

### Weller spares ★

For the W-TCP Soldering Station

HO-60 Handle ..... \$5.00

SW-60 Switch Assembly ... \$22.00

HE-60 24V Heater Element . \$19.00

BA-60 Barrel ..... \$6.95

Male/Female Connector .... \$6.95

Innerbond Discounted 30% This is normally available only in 700mm wide rolls. Our rolls are 910 mm (3ft) wide at no EXTRA cost! \$3.50 metre - 30% more Innerbond or 30% discount.

## Jaycar

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293

Mail Orders To:

Box K-39 Haymarket 2000

Post and Packing charges

\$5-\$9.99 (\$1) \$10-\$24.99 (\$2)

\$25-\$49.99 (\$3) \$50-\$99.99 (\$4)

\$100 up (\$5.50)

### SHOP HOURS

Mon-Fri 9 to 5.30

Sat 9 to 3

Sun 10 to 2

Thurs night to 8pm



# RADIO DESPATCH SERVICE

869 George Street,  
Sydney, NSW. 2000.  
(Near Harris Street)  
Phone 211-0816, 211-0191.  
WE ARE DISTRIBUTORS  
FOR: — "INTERFIL"  
INTEGRATED CIRCUITS

## FEBRUARY SPECIALS

VICTORY MPT-02 T.V. GAME UNIT .....	\$78.95 EA.
EXTRA CARTRIDGES TO SUIT .....	\$18.95 EA.
SANSEI 3300A LOGIC PROBE TESTER .....	\$35.65 EA.
TI-302 SOLDERING IRON STAND .....	\$5.50 EA.
ARLEC PS-405 3-6-9-12V/1A P/SUPPLY .....	\$18.90 EA.
CA-30 TOP COWL CAR RADIO AERIAL .....	\$4.75 EA.
8-TRACK CARTRIDGE HEAD CLEANER .....	\$0.70 EA.
"JABEL" 1 POLE-6 POSITION ROTARY SWITCH .....	\$0.50 EA.
"FERGUSON" E5K15 SPEAKER TRANSFORMER .....	\$2.00 EA.
"FERGUSON" PF2228 240V PRIM: 30V/20W TRANSFORMER .....	\$5.00 EA.
"WAHL" ISO-TIP CORDLESS SOLDERING IRON .....	\$44.10 EA.
SP-100 OSCILLOSCOPE PROBE KIT 10:1, 1:1 .....	\$34.50 EA.
P.V.C. INSULATION TAPE 20M ROLL .....	\$0.50 EA.
ARLEC PS493 KAPPAK 800MA MODEL .....	\$6.14 EA.
B/LEE L734/P/AL COAX TV PLUG 70Ω .....	\$0.70 EA.
HILLS TENNA-TRAKKA INDOOR TV AERIAL 300Ω .....	\$9.57 EA.
"M/SOUND" LIN-TRACK RECORD CLEANER .....	\$5.00 EA.

## TEXAS CALCULATORS

	EX/TAX	INC/TAX
TI-59 .....	\$224.00	\$255.40
TI-58C .....	\$135.00	\$152.36
TI-PC100C PRINTER .....	\$205.00	\$231.50
TI-55 .....	\$54.27	\$60.96
TI-54 .....	\$36.96	\$41.58
TI-50 .....	\$36.96	\$41.58
TI-40 .....	\$32.84	\$36.95
TI-30/11 L.C.D. .....	\$17.20	\$19.00
TI-LITTLE PROFESSOR .....	\$17.20	\$19.30
TI-DATA MAN .....	\$23.63	\$26.57
TI-BPIA BATTERY PACK (FOR 58/59) .....	\$7.28	\$8.12
TI-TP-30250 THERM. PAPER (3 ROLL PACK) .....	\$11.37	\$12.68

OPEN: Mon-Fri 8 am to 5.30 pm.  
Thursday night late shopping until  
8.30 pm. Saturday 8 am to  
11.45 am.

## NORTRONICS AUDIO & DIGITAL TAPE HEADS



for long life extended response

- Replacement heads for cassette decks, reel to reel decks, cartridges and cassette recorders. Also professional recorders and duplicators.
- Will fit AMPEX, SCULLY, TEAC, ATC, GATES, PENTAGON and many more.
- Specification sheet of all Nortronics heads available on request.
- Complete range of Alignment tapes for cassette, reel to reel and cartridge decks.
- REGULAR MAINTENANCE ENSURES CONTINUED OPTIMUM PERFORMANCE. Nortronics manufacturers a full range of audio care products.

MAGNETIC TAPE  
DEVELOPER



ALIGNMENT  
TAPES



SPlicing  
BLOCKS



SPlicing TABS

TAPE  
HEAD  
CLEANER



- NORTRONICS audio care products are designed to care for and maintain your valuable recording equipment.
- SEND TWO 24c STAMPS FOR OUR FREE BROCHURE ON THE COMPLETE NORTRONICS ACCESSORIES RANGE.

**E.I. EMAC  
INDUSTRIES** Pty. Ltd.

2 Bengal Crescent, Mount Waverley,  
Vic. 3149. Ph: (03) 277-9989.

**AMS** MAIL  
ORDER  
CENTRE

## TAPES CHEAP!

BULK TAPES DISCOUNTED

### Maxell

UDXL IIS C90 EPITAXIAL	12 for \$58
UDXL II C90 EPITAXIAL	12 for \$49
UDC 90	12 for \$38
LN C90	12 for \$26

### TDK

SA-X C90	EPITAXIAL	10 for \$49
SA C90	EPITAXIAL	10 for \$39
AD C90		10 for \$30
D C90		10 for \$24

## AMPEX

NEW GM II C90	10 for \$42
GM I C90	10 for \$35
EDR C90	10 for \$29
ELN C90	10 for \$23

VIDEO — OPEN REEL — METAL

MAXELL, TDK, AMPEX, AKAI

— Send for  
complete Tape Price Lists — FREE

## HI-FI SYSTEMS

AMPLIFIERS, TUNERS, TAPE DECKS,  
TURNABLES, SPEAKERS, HEADPHONES,  
RECEIVERS.

Our range includes:

**Sansui**

**PIONEER**

**marantz AKAI**  
SOUND DYNAMICS. **KSW**

## CAR SOUND

RECEIVERS, TAPE PLAYERS, BOOSTERS,  
EQUALISERS, SPEAKERS — Including:

**PIONEER Voxson**

## ACCESSORIES

CARTRIDGES, STYLII, CLEANERS,  
DEMAGNETISERS, DISCWASHER



— PARABOLIC STYLUS —  
Complete Range

**ortofon**

Moving Coil and  
Magnetic Cartridges

Ring or Write for Free Price Lists!

TAPE ORDERS:

Add: Pack and Post \$3.00 per Order  
and send cheque/money order to:

**AMS**

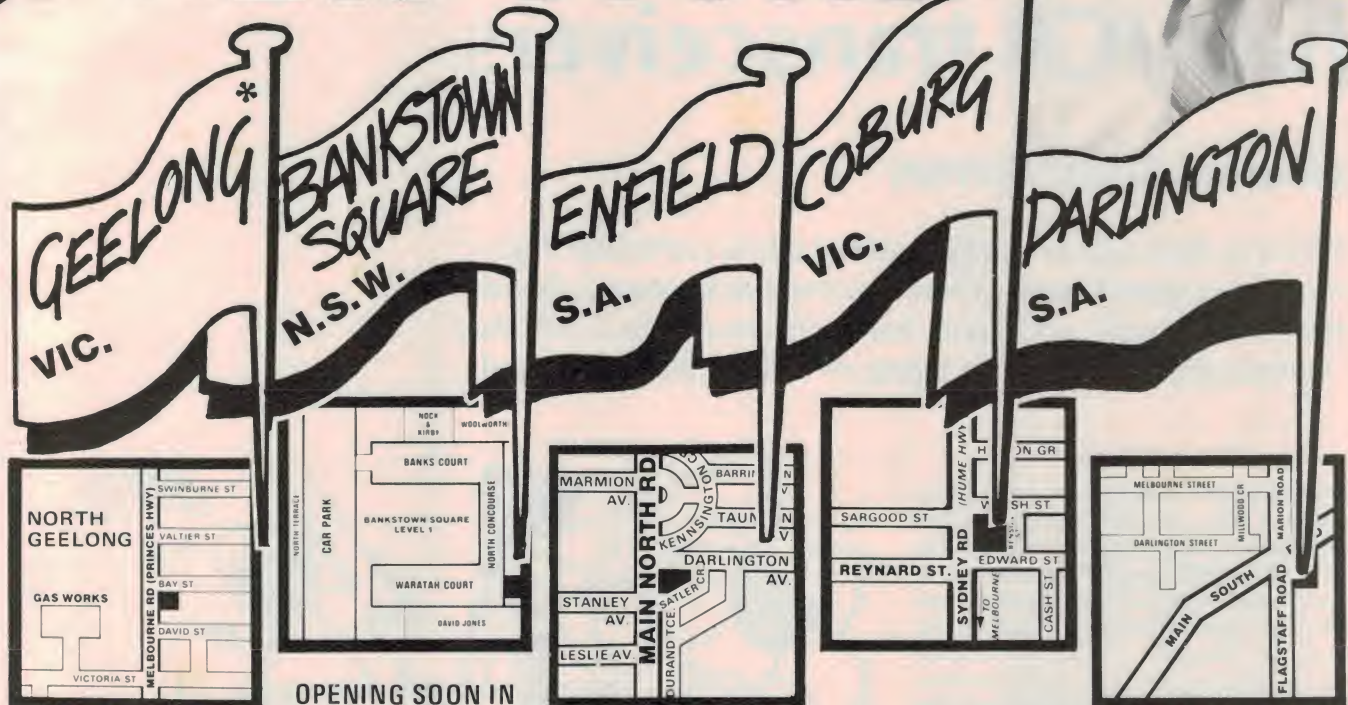
MAIL ORDER CENTRE  
135 HAWTHORN ROAD,  
CAULFIELD, VIC. 3162  
(03) 528 1149

Stock at prices shown available at time  
of going to press.



**MORE  
OPPORTUNITIES  
TO SAVE!**

# DICK SMITH OPENS 5 NEW STORES



**OPENING SOON IN  
BONDI JUNCTION!**

\*Opens late February

**Dear Customer,**

Quite often, the products we advertise are so popular they run out within a few days. Or, unforeseen circumstances might hold up goods so that advertised lines are not in the store by the time the advert appears. Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray. What we are trying to say is that, if you are about to drive across town to pick up a particular line at a Dick Smith store, why not give the store a ring first (addresses/phone numbers below) ... just in case! Thanks.

**Dick Smith and Staff.**



## DICK SMITH Electronics



**NSW** 145 Parramatta Rd AUBURN 648 0558 : T55 Terrace Level BANKSTOWN SQ. 707 4888 : 613 Princes Hwy BLAKEHURST 546 7744 : 818 George St BROADWAY 211 3777 : 531 Pittwater Rd BROOKVALE 93 0441 : 147 Hume Hwy CHULLORA 642 8922 : 162 Pacific Hwy GORE HILL 439 5311 : 396 Lane Cove Rd NORTH RYDE 888 3200 : 30 Grose St PARRAMATTA 683 1133 : 125 York St SYDNEY 290 3377 : 173 Maitland Rd TIGHE HILL (NEWCASTLE) 61 1896 **ACT** 96 Gladstone St Fyshwick 80 4944 **QLD** 166 Logan Rd BURANDA 391 6233 : 842 Logan Rd CHERMSIDE 59 6255 **SA** 60 Wright St ADELAIDE 212 1962 : Cnr Main South & Flagstaff Rds DARLINGTON 298 8977 : 435 Main North Rd ENFIELD (Opening Soon) 260 6088 **VIC** 399 Lonsdale St MELBOURNE 67 9834 : 260 Sydney Rd COBURG 383 4455 : 205 Princes Hwy CORIO (GEELONG) (Opening Soon) : 656 Bridge Rd RICHMOND 428 1614 : Cnr Dandenong & Springvale Rds SPRINGVALE 547 0522 **WA** Cnr Wharf St & Albany Hwy CANNINGTON 451 8666 : 414 William St PERTH 328 6944 **Mail Order Centre:** PO Box 321, North Ryde 2113. Phone: (02) 888 3200

**SHOPS OPEN 9am to 5.30pm  
(Saturday: 9am till 12 noon)  
BRISBANE: Half hour earlier.  
ANY TERMS OFFERED ARE TO  
APPROVED APPLICANTS ONLY**

### POST & PACKING CHARGES

ORDER VALUE	CHARGES
\$5.00-\$9.99	\$1.20
\$10.00-\$24.99	\$2.20
\$25.00-\$49.99	\$3.30
\$50.00-\$99.99	\$4.40
\$100.00 or more	\$6.00

Charges for goods sent by post in Australia only  
— not airmail, overseas or road freight.

## MAJOR DICK SMITH RE-SELLERS

**ATHERTON, QLD:** Joe Sue's Radio Service  
55 Main Street, Phone: 91 1208

**BENDIGO, VIC:** Sumner Electronics  
95 Mitchell Street, Phone: 43 1977

**BALLINA, NSW:** A. Cummings & Co.  
91-93 River Street, Phone: 86 2285

**BROKEN HILL, NSW:** Crystal TV Rentals  
66 Crystal Street, Phone: 6897

**CAIRNS, QLD:** Thompson Instrument Services  
79-81 McLeod Street, Phone: 51 2404

**COFFS HARBOUR, NSW:** Coffs Hbr Electronics  
3 Coffs Plaza, Park Ave. Phone: 52 5684

**DARWIN, NT:** Kent Electronics  
42 Stuart Hwy, Phone: 81 4749

**DARWIN, NT:** Ventronics  
24-26 Cavanagh Street

**EAST MAITLAND, NSW:** East Maitland Elect.  
Cnr Lanes & High Streets, Phone: 33 7327

**GERALDTON, WA:** KB Electronics & Marine  
381 Main Terrace, Phone: 21 2176

**GOSFORD, NSW:** Tomorrow's Electronics  
88 William Street, Phone: 24 7246

**HOBART, TAS:** Beta Electronics  
123a Bathurst Street, Phone: 34 8232

**KINGSTON, TAS:** Kingston Electronics  
Channel Court, Phone: 29 6802

**LAUNCESTON, TAS:** Advanced Electronics  
5a The Quadrant, Phone: 31 7075

**LISMORE, NSW:** Decro Electric  
Magellan St. & Brunner Hwy, Phone: 21 4137

**MACKAY, QLD:** Stevens Electronics  
42 Victoria Street, Phone: 51 1723

**MARYBOROUGH, QLD:** Keller Electronics  
218 Adelaide Street, Phone: 21 4559

**MT GAMBIER, SA:** Hutchesson's Comm.  
5 Elizabeth Street, Phone: 25 6404

**MILDURA, NSW:** McWilliams Electronics  
40 Lemon Avenue, Phone: 23 6410

**NAMBOUR, QLD:** Nambour Electronic Shop  
Shop 4 Lowan House Ann Street, Phone: 41 1044

**NEWCASTLE, NSW:** Elektron 2000  
Shop 18, Hunter Shopping Village, Phone: 26 2644

**ORANGE, NSW:** M & W Electronics  
173 Summer Street, Phone: 62 6491

**PENRITH, NSW:** Acorn Electronics  
Shop 12 541 High St, Phone: 36 1466

**PORT MACQUARIE, NSW:** Hall of Electronics  
113 Horton Street, Phone: 83 5486

**ROCKHAMPTON, QLD:** Purely Electronics  
15 East Street, Phone: 21 058

**SOUTHPORT, QLD:** Amate's Paradise  
121 Nerang Street, Phone: 32 2644

**TAMWORTH, NSW:** Sound Components  
111 Bridge Street, Phone: 32 9677

**TOOWOOMBA, QLD:** Hunts Electronics  
18 Neil Street, Phone: 32 9677

**TOWNSVILLE, QLD:** Tropical TV  
49 Fulham Road, Vincent Village, Phone: 79 1421

**TRARALGON, VIC:** Power'n'Sound  
147 Argyle Street, Phone: 74 3638

**WAGGA, NSW:** Wagga Wholesale Electronics  
62 Forsyth Street

**WODONGA, VIC:** A & M Electronics  
78a High Street, Phone: 24 4588

**WHYALLA, SA:** Mellor Enterprises  
Shop 2, Forsyth Street, Phone: 45 4764

These are our major dealers, however we cannot guarantee they will have all these items in stock and at the prices advertised.

DSE/A165/LM



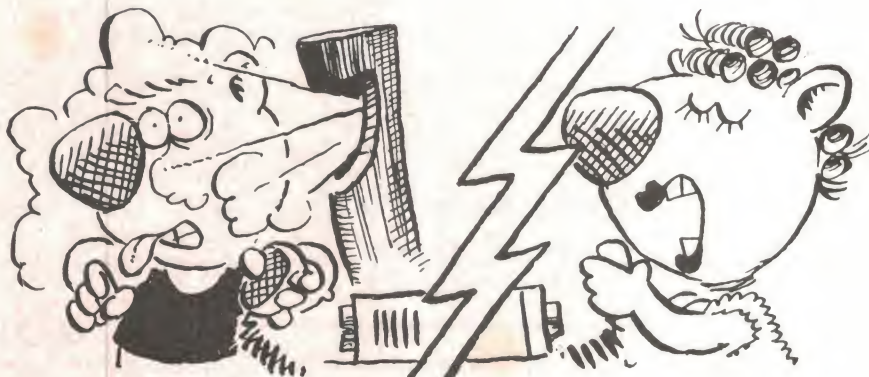
## 'Selectacall' add-on for ham/CB transceivers

Jonathan Scott VK2YBN

If you're listening on a channel for some particular station to call, but don't want to listen to the 'background chatter', then this simple accessory holds the mute shut until that 'certain party' calls — no tones or funny noises required.

ARRANGING occasional or regular contacts with a friend on-air is a pretty common practice, particularly on the VHF and UHF bands. The problem is that listening to the background chatter of other channel users — 'reading the mail', as they say — until the station you're listening for calls can be tedious. If your receiver could be muted until the wanted station calls, you wouldn't be distracted by the background chatter. Such a system was devised many years ago and became generally known as 'selective calling', which was abbreviated to 'selcall' or similar. The system employs a series of tones transmitted in a coded sequence. The listening station's receiver has a decoder fitted which detects that the correct tone code has been received and opens the mute. At least one commercially available CB rig has this as an optional extra (the Sawtron).

This project is a simpler version. No tones are employed. Instead, the 'calling' station simply keys his transmitter a pre-arranged number of times within a set period and the 'listening' station's receiver decodes this and triggers an alarm and an indicator. Optionally, the listening station's transceiver can be keyed by the decoder to indicate or acknowledge reception of the caller's code (QSL for the cognoscenti). As the decoder depends for its operation on the receiver mute detecting a carrier, it is only suited to AM or FM operation. ►



'Reading the mail' ... can be tedious.

### HOW IT WORKS — ETI-723

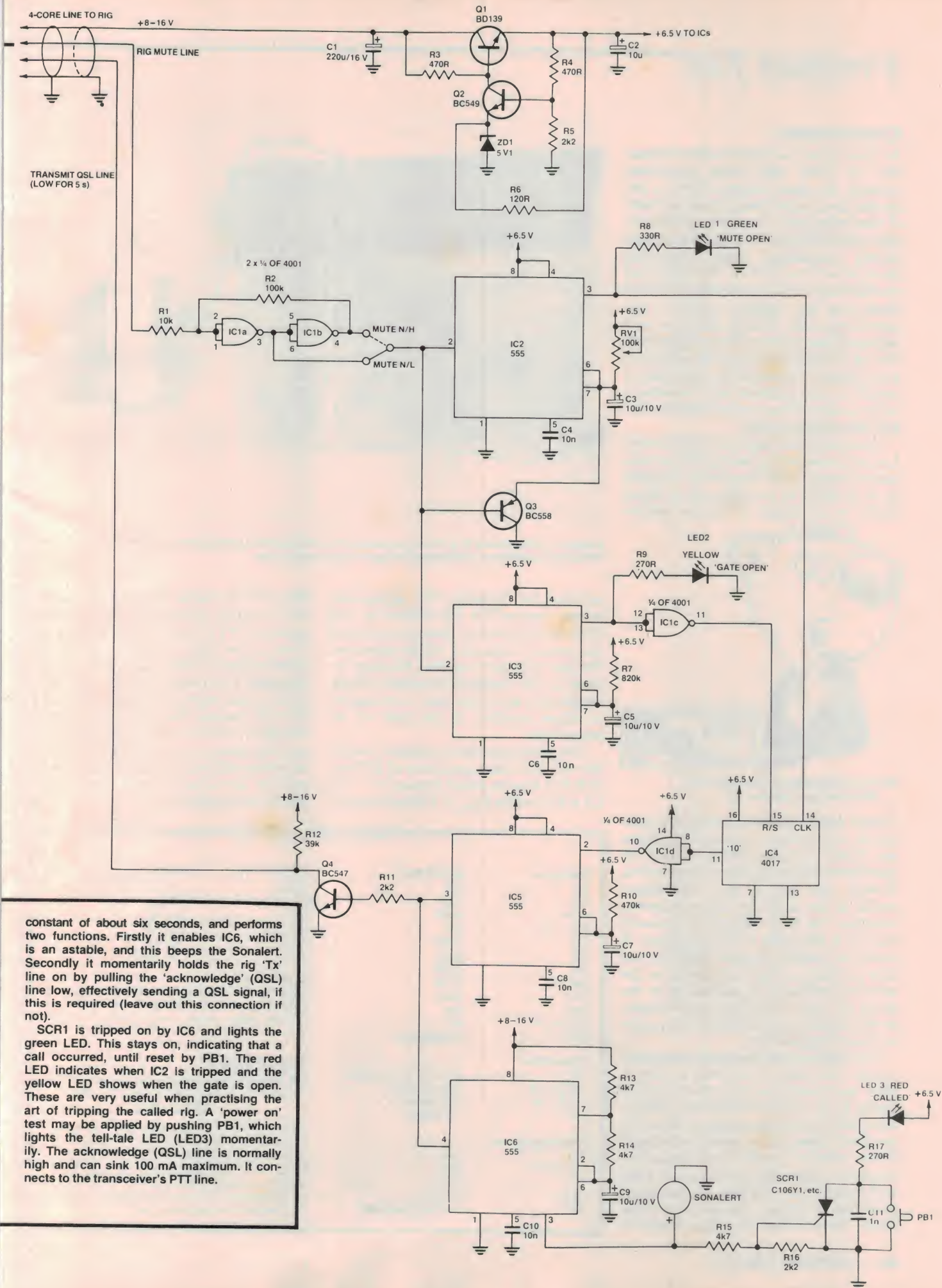
Basically, the device monitors the mute-lift signal in the receiver, searching for a string of nine (or other preset number) discrete mute-lift pulses occurring within a fixed period. The pulses must not occur too frequently (as set by a trimpot) nor may they be of too low a frequency, as they would not all be registered in the fixed period. With only a brief amount of practice, these pulses can be generated by manual depressions of the PTT button of another rig, and thus the unit will respond to a 'select-call' made without any specific hardware. The unit emits a distinctive beeping tone and sets a LED when it detects a valid call.

Initially, let us consider the idle state of the unit. ICs 2, 3 and 5 are monostable multivibrators, all of which are resting in their stable (reset) states. IC4, which is a decade counter/decoder, is held reset to 0. IC6 is disabled, and all LEDs are extinguished. IC1a and b form a Schmitt input

buffer. Q1 and Q2 and associated components form a power supply regulator delivering 6-7 volts.

When the mute line shifts out of its 'closed' or 'reset' state (be this high or low, as set by an internal connection) IC1a and b send a low pulse to IC2 and IC3. Both of these monostables send their outputs high. IC3 has a time constant of about nine or ten seconds, and commences timing immediately. IC2 has a time constant of up to one second (set by RV1) and starts timing only when the mute line returns to its rest state, as a result of Q3 shorting C3. When IC2 times out as a result of the mute closing, and the period of its cycle passing, its output falls. Its cycle may be repeated by further openings and closings of the mute. Each time this occurs, IC4 is incremented by one count. Provided IC2 is triggered the required number of times before IC3 times out, IC4 will trigger IC5. IC5 has a time





constant of about six seconds, and performs two functions. Firstly it enables IC6, which is an astable, and this beeps the Sonalert. Secondly it momentarily holds the rig 'Tx' line on by pulling the 'acknowledge' (QSL) line low, effectively sending a QSL signal, if this is required (leave out this connection if not).

SCR1 is tripped on by IC6 and lights the green LED. This stays on, indicating that a call occurred, until reset by PB1. The red LED indicates when IC2 is tripped and the yellow LED shows when the gate is open. These are very useful when practising the art of tripping the called rig. A 'power on' test may be applied by pushing PB1, which lights the tell-tale LED (LED3) momentarily. The acknowledge (QSL) line is normally high and can sink 100 mA maximum. It connects to the transceiver's PTT line.



# Project 723

## Construction

As this circuit is likely to be of appeal only to those with some experience already, the construction is left to the greater part to the imagination and skill of the individual. Our (pictured) prototype was built into one of PacTec's small plastic instrument cases measuring about 40 x 140 x 140 mm. The LEDs and pushbutton were mounted on the front panel and the Sonalert alarm in the upper case half. This produced a neat outboard unit which can be plugged into the rig. It would also be quite possible to incorporate it into the rig case itself or install it in an outboard unit containing other units such as a power amp or output monitoring device.

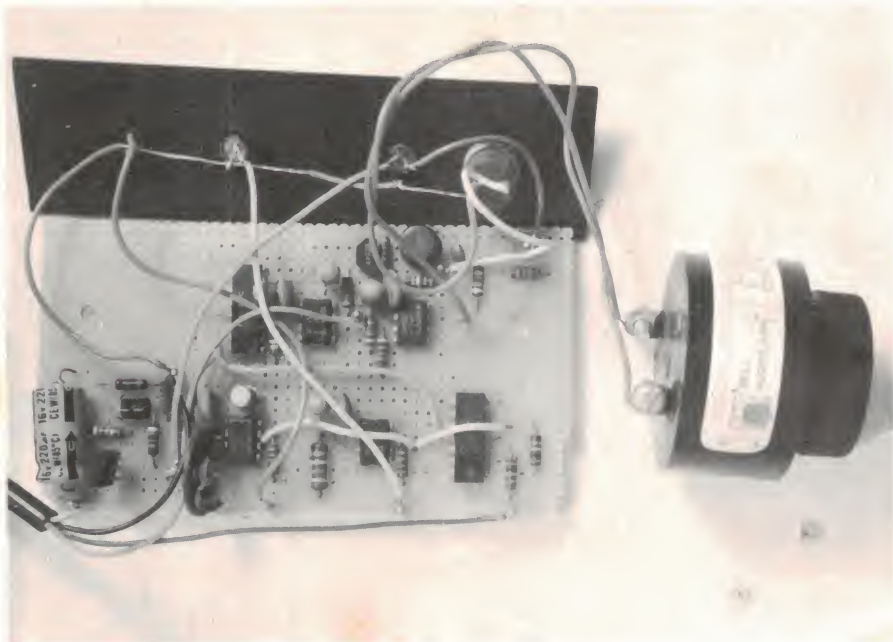
Our circuit was built on matrix board. Layout is not critical except that an adequate amount of RF bypassing is needed as it is likely to be subjected to strong fields in the shack. If trouble occurs,



How many times do I push the button?  
... Why don't you answer me?

liberal application of ceramic and tantalum capacitors is prescribed. There are three variables which need to be considered before starting construction. Firstly, one only of two connections needs to be made in order to preset whether the unit expects a *normally high* or a *normally low* mute signal. It would be possible to put in a switch, but this is likely to be unnecessary as the unit will probably be hooked up to the same rig most of the time and another switch is just something else that can be in the wrong position.

It is also required to decide how many pulses the circuit will need to find to trip, and what the pulse frequency is going to be. If more than one unit is expected to be monitoring one channel it is wise to agree on the above beforehand. If two devices on the same frequency respond to the same pulse speed, they will interfere and at best be indistinguishable; at worst, one will mask the other. The number of pulses needed is



A piece of matrix board 63 x 115 mm is used to mount most of the components — layout is not critical — the LEDs, pushbutton and Sonalert being mounted on the case.

selected by choosing the appropriate output line on IC4. We elected to have nine, as there was no desire to minimise the count or separate caller sequences. Besides, the more needed, the more remote is the chance of misscalls. These, incidentally, are quite rare — we had one in three months, to the best of our knowledge.

The pulse frequency 'window' is set by the relative time constants of IC2 and IC3; IC3 is set to about 10 secs ( $T = 1.1 \times C5 \times R7$ ) and so  $F_{min} = 1/10 \times 9$  (about 1

Hz). IC2 should be set by RV1 to about half a second. Allowing for the limiting speed of a PTT button finger, this represents a maximum frequency of  $1\frac{1}{2}$  Hz, or thereabouts. These must obviously be changed if you wish to have a very different pulse repetition range. Reducing R7 will shorten the gate time proportionately, and vice-versa. The pot., RV1, can be made to give wide or narrow windows with the values given but may require increasing if you increase the gate time significantly.

## PARTS LIST — ETI 723

### Resistors all $\frac{1}{2}W$ , 5%

R1	10k
R2	100k
R3,4	470R
R5,11,16	2k2
R6	120R
R7	820k
R8	330R
R9,17	270R
R10	470k
R12	39k
R13,14,15	4k7
RV1	100k trimpot

### Capacitors

C1	220u/16 V axial electro.
C2,3,5,7,9	10u/10 V tant.
C4,6,8,10	10n ceramic
C11	1n ceramic

### Semiconductors

IC1	4001
IC2,3,5,6	555
IC4	4017
SCR1	C106Y1
LED1	TIL220G green LED

LED2	TIL220Y yellow LED
LED3	TIL220R red LED
Q1	BD139
Q2	BC549
Q3	BC558
Q4	BC547
ZD1	5V1 zener

### Miscellaneous

Matrix board; piezoelectric alarm (Sonalert, or similar); case to suit; pushbutton (PB1); 4-core shielded cable; cable clamp or clamp grommet, etc.

### Price estimate

We estimate that the cost of purchasing all the components for this project will be in the range:

**\$21 — \$28**

Note that this is an **estimate** only and **not** a recommended price. A variety of factors may affect the price of a project such as — quality of components purchased, type of pc board (fibre-glass or phenolic base), type of front panel (if used) supplied etc — whether bought as separate components or made up as a kit.





# ELECTRONIC MUSIC

## *you can build and SAVE!*

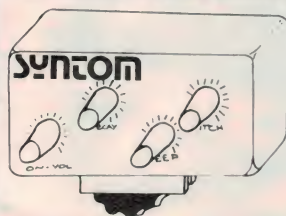


### DRUM SYNTHESISER KIT

JOIN THE DRUM REVOLUTION

Original design from the UK magazine "Electronics and Music Maker" April 1981. This self-contained unit can produce a variety of fixed and falling pitch effects triggered either by tapping the unit itself or striking an existing drum to which the unit is attached! The Jaycar "SYNTOM" Drum Synthesiser comes complete with a high quality PRE-DRILLED moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.

FEATURES: Decay from less than 0.1 second to several seconds Pitch control — sweep control and volume on/off.



As used by WARREN CANN of "ULTRAVOX"  
Send SAE for more information.

**\$36.50**



programmable  
master rhythm  
generator  
FULLY IMPORTED

This project was originally described in the UK publication "Practical Electronics". We have fully imported "Clef" kit This attractive kit is presented in an attractive metal cabinet with silkscreened front panel.

The Master Rhythm can be programmed (in RAM) to play back:  
— 24 Rhythm patterns      8 parallel tracks      12 instruments  
It is also capable of sequence operation — the ULTIMATE UNIT

complete **\$199**

SEND SAE FOR  
DESCRIPTIVE LEAFLET  
LOW BATTERY  
POWER DRIVEN

### 8 channel mixer kit

Due in stock before end of January  
Basic functions of 19"x14" rack  
mountable mixer panel:

- 8 balanced inputs line/mic switch
- Input attenuator
- Bass/Mid/Treble equalisation
- Foldback & effects send
- Stereo pan
- 60mm slides
- Professionally formatted panel
- VU's on master monitors
- 5 band graphic on monitors
- Master effects send/receive
- Effects stereo pan
- Master foldback

Total cost of all above including all electronics, knobs, professional black heavy gauge prepunched & silkscreened front panel — \$495

Console mount chassis and power supply ONLY \$98.00

Set of Cannons included in the price. (worth over \$30!!!)

**only \$495**

### chorus generator kit

This kit consists of a PCB measuring 115x130mm and all components including Bucket-Brigade Delay lines and instructions. (A — 15V power supply is required at an extra \$14, if purchased from us). The Chorus Generator creates an apparent multiplicity of sound sources (i.e. 'Chorus') from a single-phase signal. Sophisticated but straightforward circuit using 2 BBD's, 2 VCO's, fast & slow modulator, low pass filters etc. Add new effects to your music!

**only \$59**

### "Blueprint" 5000 preamp



**\$275**

We have produced a vast number of kits for this fantastic preamp and we have subsequently learnt a lot about them.

To celebrate our first years trading and as a tribute to the perfectionists amongst you we are offering a very special kit.

THE "BLUEPRINT" 5000 PREAMP.

This kit is individually assembled with only the highest quality components including:

- Gold plated RCA jacks on ALL phono inputs.
- 1 x pair of Gold plated RCA line plugs.
- Military specification LM194 in lieu of the commercial grade LM394.
- Low capacitance screened cable used throughout — over 12 metres total.
- All I.C. sockets provided (high quality sockets).
- Special multi-coloured LED display no cost optional extra.
- All metal film resistors used.
- Pretinned PCBs.
- Special black anodised rear panel with silkscreened white lettering and format borders.

The standard kit is still available at only \$245.00.

Ref: ETI July '81-Oct '81

### 5000 POWER AMPLIFIER

PERHAPS THE PERFECT REALISATION OF THE CLASSIC POWERFET AMP DESIGN.

The Jaycar kit of this project is being continuously updated in quality so that the constructor will benefit. We now supply metal film 1% 50ppm resistors in place of carbon film types. All Aluminium hardware (including heatsink bracket) is now anodised in black. (Incidentally there has never been a problem with instability with Jaycar kits. We have ALWAYS used high quality capacitors).

The original square-section chassis bars are used. And then there is the Superfinish frontpanel!

Specifications: Power Output — 100 watts r.m.s. into 8 ohms x2  
Frequency Response — 8Hz to 20kHz, +0 — 0.4dB. Noise — 116dB below full output. Input Sensitivity — 1V r.m.s. for 100 watt output.  
For full specifications see magazine article on this amplifier.



Ref: ETI Jan '81-April '81

With Superfinish  
front panel \$299

### Lyrebird Piano

This fantastic kit is now available ex-stock. If you prefer the full 88 note 7½ octave version we have this also. Each kit is complete down to the last screw and washer! Buy the complete kit or buy the individual modules. Modules start from \$47 for the hardware pack through to the full 73 note keyboard at \$169.50.

The 'Lyrebird' covers 6 octaves from F-F. The controls include: normal voice, mellow voice, bright voice, harpsichord voice, honky tonk voice selects. Plus many other features. A great kit for the piano enthusiast.

6 OCTAVE \$525

7½ OCTAVE \$589

Ref: EA Oct '81-Jan '82



EXCLUSIVE!!!

- Metal film 1% resistors used
- All Aluminium panels now anodised
- Original design chassis bars — heavy gauge extruded section heatsink bracket
- Prewound output chokes
- Flux shorting straps on transformers
- And then there's the Superfinish heatsink

**\$289**

**Jaycar**

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293

Mail Orders To:

Box K-39 Haymarket 2000

Post and Packing charges

\$5-\$9.99 (\$1) \$10-\$24.99 (\$2)

\$25-\$49.99 (\$3) \$50-\$99.99 (\$4)

\$100 up (\$5.50)

SHOP HOURS

Mon-Fri 9 to 5.30

Sat 9 to 3

Sun 10 to 2

Thurs night to 8pm



# David Reid Electronics

now better  
than ever.

**SINCLAIR**  
**ZX81**  
Personal  
computer

**\$248**

Complete with mains  
adaptor, leads & basic  
manual

New, improved specific-  
ation

- Z80 a microprocessor  
— new faster version of  
the famous Z80 chip,
- Unique 'one-touch' key  
word entry: the ZX81  
eliminates a great deal of  
tiresome typing.
- Graph drawing and  
animated display facilities.

**'ARRIVED' — the ZX  
Printer**

Designed exclusively for  
use with the ZX81 (and  
ZX80 with 8K BASIC  
ROM).



**ONLY  
\$180-00**

"You've had your holiday, so if you're  
serious about electronics, you are  
going to require top line test equip-  
ment, we recommend Kaise"

**MODEL SK-6440 Digital Multitester**



**ONLY  
\$95-41**  
Tax incl.

**DISPLAY:**  
a. Numerical Display: 3.5 digit LCD, 10mm  
high, maximum reading 1999  
b. Unit and Sign: mV, V, mA, A (Model SK-  
6330 & SK-6440), K AUTO, BATT,  
ADJ, LO, —, AC  
**OPERATING PRINCIPLE:** Dual Slope  
Integration  
**RANGE SELECTION:** Autoranging on  
VOLT and OHM Manual range selection  
is also available on Model SK-6300 and  
SK-6330 by Range Keyswitch  
**POLARITY:** Autopolarity, (—) sign when  
minus  
**OVERRANGE INDICATION:** MSD "1"  
blinks Buzzer Warning on Model SK-6300  
and SK-6330 only  
**ZERO ADJUSTMENT:** Zero Adjustment  
by ZERO ADJ. Keyswitch  
**LOW POWER OHM RANGES:** for in-circ-  
uit resistance measurements at voltage  
levels below 0.3 volts.

- MODEL SK-550: with AUTOMATIC RESET  
OVERLOAD PROTECTIVE RELAY and OVERLOAD  
WARNING BUZZER/LED for safety measurements  
and easiest operation. Internal circuit returns ON  
in every 5 second while receiving overload.

DC Voltage	0.06(60mV), 0.3, 3, 12, 60, 120, 300, 600, 1200V
AC Voltage	6, 30, 120, 300, 600, 1200V
Decibels	-20 +17, 31, 43, 51, 57, 63dB
Accuracy	DC $\pm 3\%$ AC $\pm 4\%$ Resistance $\pm 3\%$ (full scale length)
Overload Protection	Overload Protective Relay, one pair of Diodes, one Fuse

☆☆☆☆

**DIGITAL MULTIMETERS (3 1/2) L.C.D.**

	TRADE	TAX	TAX INCL.
SK6100 Auto Range—Range Hold Overload Buzzer.	\$108.00	14.18	122.18
SK6110 As SK6100 + 10 Amp AC/DC Range	118.00	15.49	133.49
SK6200 Auto Range — 20 Ranges	69.50	9.13	78.63
SK6220 As SK6200 + 10 Amp AC/DC Range	79.50	10.44	89.94

**ANALOG METERS**

SK550 100K Ohm/V — Overload Relay and Buzzer	89.50	11.75	101.25
SK510 Similar to SK550 (With Transistor Test)	77.00	10.11	87.11
SK520 Similar to SK550 (With Capacitance Test)	82.00	10.77	92.77
SK50 50K Ohm/V 3KV and 12 A.D.C. — 22 Ranges	49.00	6.44	55.44
SK110 30K Ohm/V — Transistor/Diode Test	42.00	5.52	47.52
SK240 20K Ohm/V — 18 Ranges. 1000V AC/DC	30.50	4.01	34.51
SK142 20K Ohm/V — 15 Ranges	25.00	3.29	28.29
SK2 5K Ohm/V — 12 Ranges	16.00	2.10	18.10

**ELECTRICIANS METERS**

SK242 20K Ohm/V Multi-meter (with Light Sensor Facility)	28.00	3.68	31.68
SK7000* Clamp Meter 0-300A/0-600V 8 Ranges	69.00	9.06	78.06
SK3300 Insulation Tester 500V — 100 Meg/Ohm	149.00	19.56	168.56
SK9000 30K/V — 45 KV DC Direct Read Probe	38.50	5.06	43.56
SK2200 SWR/FS Meter. 200 Watt — 3.5 to 150 MHz	25.00	3.29	28.29
LS242 Light Sensor (use with SK242)	21.00	2.76	23.76

\* INCLUDES CARRY CASE AND LEADS

**CARRY CASES**

SK6000	3.50	0.46	3.96
SK110/50	10.50	1.38	11.88
SK550	13.50	1.78	15.28
SK2	5.50	0.73	6.23
SK142/240/242	9.50	1.25	10.75

Yes we are also  
stockist of the  
**ATARI 400**  
PERSONAL COMPUTER SYSTEM



**YOUR COST  
ONLY \$699.00**

The 400 is supplied with  
8K bytes of RAM, and offer  
a 10K ROM Operating  
System and an 8K ATARI  
BASIC Language Car-  
tridge.

The 400 features 4 indep-  
endently programmable  
sound synthesizers and a  
built-in speaker.

**Talking about ATARI we  
stock And sell a full range  
of Cassettes for the T.V.  
Game Computer System.**



**System Priced only**

**\$265.**

**Sells elsewhere  
RRP \$314.00**

Cartridges @ \$39.95  
\$49.95  
\$59.95

**DAVID REID  
ELECTRONICS  
PTY. LTD.**

**SYDNEY:**  
127 York Street  
Sydney 2000 N.S.W.  
P.O. Box Q103  
Sydney 2000 N.S.W.

Part No.	Description	Quantity	Price	Total
Please print clearly. Date .....				1.00
Minimum Postage/Packing charge				
Plus Postage/Packing surcharge				
Name .....			Subtotal	
Address .....			TOTAL	
Postcode .....				

Enclose your personal cheque,  
Money Order or Bankcard Numbers  
as specified below:

Check and fill in  
☐ Cheque or Money Order Enclosed  
☐ Charge to my Bankcard No.  
CARD HOLDER'S NUMBER

496

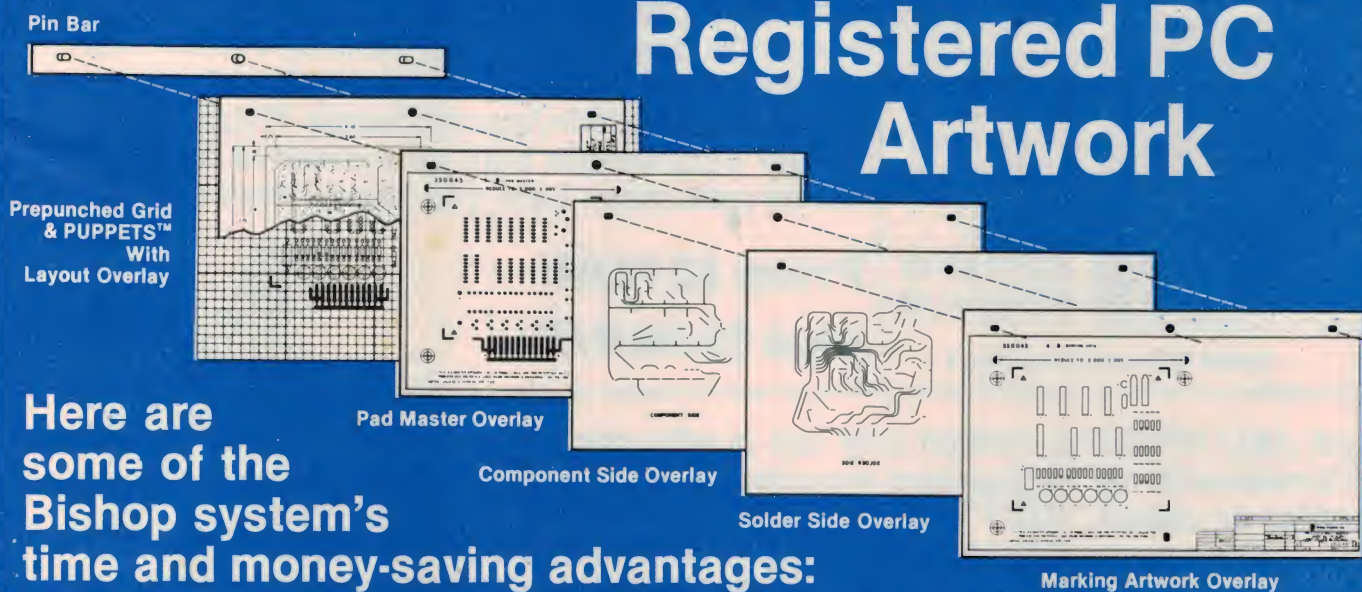
Signature .....

Card Expiry Date .....



# NEW! *The Innovators* Bishop Graphics

## OVERLAY DRAFTING SYSTEM... The Fast, Error-Free Way to Accurately Registered PC Artwork



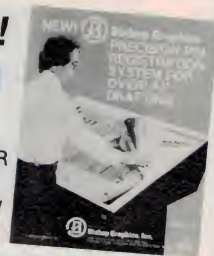
Here are some of the Bishop system's time and money-saving advantages:

- Precision registration and accuracy
  - Consistent locational accuracy of  $\pm .002"$  (0,051 mm) on any overlay sheet size
  - Insures absolute constant perpendicular registration
  - Universal pin design prevents artwork film from buckling, stretching, or slipping due to temperature and humidity changes
- Register PC artworks without using targets
- Cuts down man-hours required for registration, taping and production of PC artwork and associated documents

- A complete "off-the-shelf" system including factory precision, PREPUNCHED grids and stable-based ACCUFILM®

### WE SHOW YOU HOW! FREE! Bishop Technical Manual No. 1022R

Our "How To" Technical Manual No. 1022R includes special PC artwork step-by-step instructions and illustrations . . . Send now for your FREE copy.



**FOR COMPLETE DETAILS, CONTACT YOUR LOCAL BISHOP GRAPHICS DEALER:**

#### VICTORIA

STEWART  
ELECTRONIC  
COMPONENTS  
PTY. LTD.  
44 Stafford Street,  
Huntingdale 3166  
Tel: 543 3733  
Telex: AA 36908

#### WESTERN AUSTRALIA

W. J. MONCRIEFF  
PTY. LTD.  
176 Wittenoom Street,  
East Perth W.A. 6000  
Tel: 325 5722  
Telex: AA 93022

#### QUEENSLAND

L. E. BOUGHEN  
& CO.  
Cnr. Baroona &  
Milton Rds.  
Milton Qld. 4064  
Tel: 36 1277  
Telex: AA 41500

#### SOUTH AUSTRALIA

GRAPHIC  
ELECTRONIC  
INDUSTRIES  
PTY. LTD.  
41A Rundle Street,  
Kent Town S.A. 4067  
Tel: 42 6655  
Telex: AA 88646

#### NEW SOUTH WALES

CIRCUIT  
COMPONENTS  
(A/Asia) PTY. LTD.  
P.O. Box 70  
383 Forest Road,  
Bexley N.S.W. 2207  
Tel: 59 6550 59 3720  
Telex: AA 27197  
CIRCOM

#### A.C.T.

GEORGE  
BROWN  
& CO. PTY. LTD.  
23 Whyalla Street  
Fyshwick A.C.T.  
2609  
Tel: 80 4355  
Telex: AA 62128



# ALL ELECTRONIC COMPONENTS

*That's our name . . . that's our game!!!*

**MAJOR STOCKISTS OF ALL GENERAL RADIO AND ELECTRONIC COMPONENTS**

**"WE ARE NOW OFFICIAL INTERSIL DISTRIBUTORS"**

Check our low prices on these fabulous products by "INTERMIL". O.E.M.'s & Resellers enquiries welcome.

ICM 7211 .....	\$11.84	ICM 7215EV/Kit .....		ICL 8038 CC .....	\$6.70
ICM 7226B .....	\$35.25	(Stopwatch Kit) .....	\$36.56	ICL 8069 CC SQ .....	\$3.45
ICM 7556 IPD .....	\$ 2.20	ICL 7650 CPD .....	\$5.85	Product & Data Book etc. etc. ....	\$14.10
ICM 7555 IPA .....	\$1.70	ICL 7660 CPA .....	\$4.28		

Prices include Sales Tax. Allow \$2.00 Pack and Certified Post.

**ETI AND EA KITSET SPECIALISTS (LARGEST RANGE IN AUSTRALIA) — TOP QUALITY, LOW PRICES**  
**LEARN WHILE YOU BUILD**

## BASIC ETI 660 COMPUTER only \$99. Plus \$5 P/P



Complete with colour option, keyboard, power supply, programmed EPROM, R.F. modulator, case etc.

**\$230 plus  
\$8.50 P/P**

Refer ETI October 1981

## JOIN THE GOLDRUSH

### ETI 1500 KITSET. Super unit featuring:

- Tune and discriminate • 4 modes of operation
- VLF/TR design • Ground balance • Auto balance push buttons • Pre-wound search heads • Very professional unit • Approximately 1/3 price of many similar commercial built up locators • Audio and meter indication. Lets you know when to rejoice

**Price: \$214.64  
plus \$8.50 P/P**



All AEC KITSETS contain only top quality prime specifications' components by recognised manufacturers. Don't be misled by other so called "KITS" which do not meet ETI and EA standards.

***Give yourself and your Kitset every chance of success.***

**ALL PARTS COVERED BY MANUFACTURERS WARRANTY**

### ETI 549 KITSET

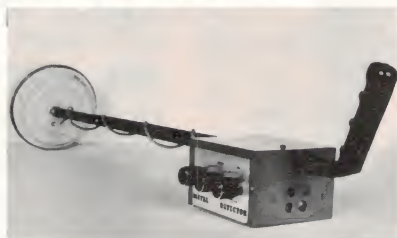


Features include:

- Induction balance • Volume and level control • Phone jack
- Dual sensitivity • Audio and meter indication

**Price: \$59.31 \* plus \$5.00 P&P**

### ETI 561 KITSET



Features include:

- B.F.O. principle • Crystal controlled • Good sensitivity
- Simple construction • Low cost

**Price: \$33.85 \* plus \$5.00 P&P**

### EA PROSPECTOR KITSET



Features include:

- B.F.O. principle
- Easy to build
- Low cost

**Price: \$38.76 \* plus \$5.00 P&P**

*\*Search heads not included.*

E. D. & E. (SALES) PTY. LTD., NOW

**ALL ELECTRONIC COMPONENTS**

118 LONSDALE STREET, MELBOURNE, VIC. 3000. TEL: 662-3506.



# MicroPro INTERNATIONAL CORPORATION

**WordStar™**  
**DataStar™**  
**MailMerge™**  
**SuperSort™**  
**SpellStar™**



**NEW**

**WordStar-Apple™**  
**CalcStar™**

**AE ADAPTIVE ELECTRONICS P/L**

For immediate delivery contact:  
 MARTIN COLLETT ON (03) 267 6800  
 Dealer Enquiries Welcome.

418 ST. KILDA ROAD, MELBOURNE 3004.  
 Ph: (03) 267 6800 (4 lines). Telex: AA32565

**Software**  
**Source Pty Ltd.**

89 OXFORD ST.,  
 BONDI JUNCTION  
 PH: (02) 389 6388 P.O. BOX 364,  
 EDGECLIFF 2027

**SOFTWARE  
 AND  
 PERIPHERALS  
 FOR THE  
 SORCERER**

**WRITE FOR  
 FREE  
 CATALOGUE**

**TRY THIS EXCITING  
 HOBBY!**

Build your own Organ, at  
 half the cost of a  
 ready-built Organ.  
**WITH WERSI ORGAN  
 KITS**

Wide range of models:  
 COMBO to large CHURCH ORGANS



**Also  
 available  
 ready-built.**

- Also
- STRING ORCHESTRA
  - BASS SYNTHESIZER
  - ELECTRIC PIANO
  - and the famous  
 WERSIVOICE  
 ROTATION SOUND

For a Colour Catalogue send 80c.  
 Klaus Wunderlich Demonstration Record, music only with jacket  
 notes — \$7.00 (incl. postage.)

**CLEFTRONICS PTY. LTD.**  
 9 Florence St., Burwood, Vic. 3125  
 Phone: (03) 288-7899

**27 MHz  
 RADIO  
 CONTROLS**

If you are looking for REMOTE  
 CONTROLS for garage door con-  
 trols, security systems, alarms  
 etc.,

**TALK TO US FIRST!**

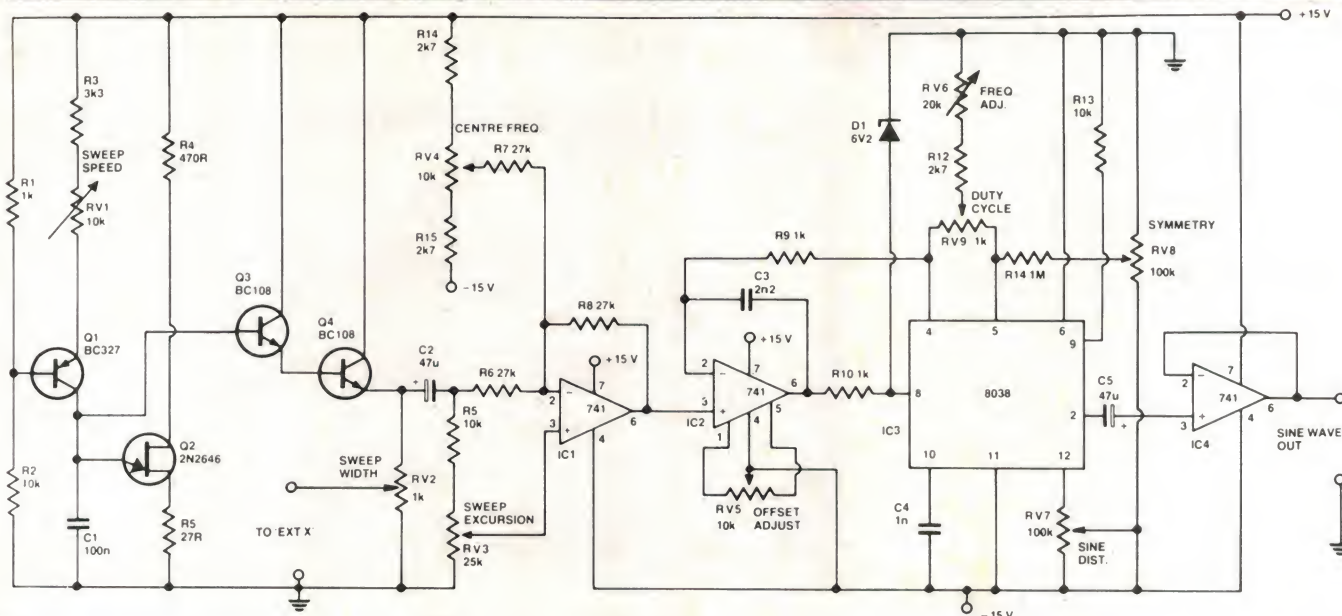
We are Australia's leading  
 maker. Our range covers most of  
 your requirements.

**ELSEMA**  
 PTY. LTD.

73 Kootingal Street,  
 Greystanes, NSW. 2145.  
 Phone (02) 636-3162



# short circuits



## Sweep generator

AN INTERSIL 8038 voltage-controlled oscillator can form the basis for a highly accurate sweep frequency generator when driven by a sawtooth waveform.

In the circuit, Q1 and Q2 form a linear sawtooth generator, with Q1 providing a constant current source charging capacitor C1 until the unijunction transistor Q2 conducts, discharging C1 through R5. Potentiometer RV1 adjusts the period of the waveform, normally about 20 ms, and hence the sweep speed.

Q3 and Q4 are a Darlington pair which reduce the non-linearity of the sawtooth due to loading. RV2 is a sweep width adjustment for the external X-input of an oscilloscope. IC1 enables

the amplitude and average dc level of the sawtooth to be varied independently, thus varying the sweep excursion (RV3) and the centre frequency (RV4).

IC2 provides a buffered input to the function generator and also compensates for the non-linear voltage-to-frequency characteristics of the 8038 by applying feedback through R9 from one of the two current sources on the 8038. IC4 provides a buffered sinewave output.

With zero volts applied to pin 8, i.e.: RV4 set to mid-range and RV3 at ground, the frequency of oscillation is given by:

$$f = 0.15 / ((RV6 + R12) \times C4)$$

For the component values shown this

ranges from approximately 6 kHz to 55 kHz. RV6, R12 and C4 may be chosen to provide a centre frequency from 1/1000 Hz to 1 MHz. However, for optimum performance the charging current through RV6 and R12 should be in the range 20 uA to 2 mA. Once RV6 is set, further variation of the centre frequency is obtained with RV4.

The duty cycle may be varied over a range of 50% by RV9, and a sweep excursion of up to 1000:1 is obtained by adjusting RV3. RV8 adjusts the symmetry and RV9 adjusts the distortion of the sinewave output. The output distortion was found to be less than 1% with a linearity of better than 0.1%.

Barry K. Ward CSIRO Division of Applied Physics

Manual Temperature Controlled  
5 Second Heat.

• 'BEST VALUE FOR MONEY'

**MINI SCOPE**

- \* FAST 5 SECOND HEAT UP
- \* FINGER TIP TEMPERATURE CONTROL
- \* FINGER TIP WATTAGE CONTROL
- \* FAST COOL DOWN
- \* COOLER BARREL AND HANDLE

Model MS

**SCOPE**  
3.3 VOLT SAFETY  
TRANSFORMER  
CODE: TF

\* Comment made by Ian Truscott

**IAN J. TRUSCOTT ELECTRONICS**

CNR EASTFIELD & BAYSWATER ROADS,  
SOUTH CROYDON, VICTORIA

TELEPHONE 723 3860

**Semi Conductor Specials:**

BLX67 .....	\$6.50
2N4427 .....	95 cents
AC187 .....	75 cents
AC128 .....	75 cents
2SD186 .....	40 cents
(GER., NPN, 25C)	
OA91 .....	15 cents
	(\$12 per 100)
BA102 .....	45 cents
	(\$40 per 100)
BZX79/C11 .....	10 cents
	(\$8 per 100)
BYX 21L/200R .....	\$1.30

WE CARRY A COMPREHENSIVE RANGE  
OF ELECTRONIC COMPONENTS  
AT VERY KEEN PRICES



# HALF PRICE COMPUTER!

*it had  
to happen!*

Are you fed  
up with 'built up' projects?  
Why not build this very high  
quality kit computer and save  
over 50% on equivalent built  
up units!

## A FULL SIZE COMPUTER KIT

You are supplied with a full  
board including power-on  
EPROM monitor, 16K of RAM,  
cassette interface (relay  
activated) for universal control  
of any tape recorder, TV  
modulator and direct video  
output PLUS full size  
professional keyboard - not a  
'feel less' toy.

ALL THIS  
FOR ONLY **\$295**

Cat. K-3600

### OPTIONAL EXTRAS

Transformer (M-2325) .....	\$23.00
BASIC interpreter (tape) (K-3602) ...	\$24.50
IC socket set (K-3603) .....	\$12.50
BASIC in EPROM (K-3604) .....	\$99.50
S-100 Expansion (K-3606) .....	\$19.50

Yes, this would make the fully assembled  
computer with above options.

**ONLY \$355.00**

**DICK SMITH ELECTRONICS**

See our other advertisements in this publication  
for address details

OUR MOST  
POPULAR  
KIT EVER!

THE  
FANTASTIC  
**SUPER 80**

Any extra parts  
shown in illustration  
are sold as  
separate, chargeable  
items.

Construction details and a full copy of the EA article is supplied  
with each kit. We also have available two very comprehensive  
manuals to assist in construction and programming:  
SUPER 80 Technical Manual (B-3600) ..... \$12.50  
SUPER 80 BASIC Handbook (B-3602) ..... \$14.50  
This book has over 50 separate versatile commands. Features  
arithmetic and integer functions, user-defined functions,  
machine language routines, text editing, string operations. Also  
contains 25 error codes to assist you in programming.

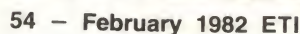
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★  
**STOP PRESS ... NEW ADDITION FOR**  
**YOUR SUPER 80.** Lower Case Generator Option avail-  
able February '82. **\$69.50.** Cat. K-3607  
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★  
DSE/A163/PAI





These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

having S1 open. You can make a 'Space Wars laser' sound by first setting S2 to C1 and adjusting each trimpot (commencing with the 'top' one driven from the '0' output) so that the first note is a high pitch and all the notes descend in pitch, with the lowest trimpot set to a suitable low note. Close S1 and adjust RV1 to give the 'right' sound.





you can have all the features  
of expensive commercial amps  
at a fraction of their price

...when you build the

# Playmaster Mosfet Amp

This is it: the new Playmaster Power Mosfet Stereo Amplifier, as described in January 1981 issue of Electronics Australia. It's the latest in the incredibly successful series of Playmaster Amplifiers (over 10,000 Twin 25's and 40/40's built!) but this one really has everything!

- State-of-the-art POWER MOSFETS!
- Low-noise FET input pre-amps!
- Over 50 watts per channel!
- Speaker switching plus loudness & muting controls!
- And a brand new professional styling!
- Complete with our famous step-by-step instruction manual!

OUR MOST  
POPULAR  
KIT EVER!



Cat. K-3515

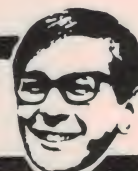
DSE/A166/PAI

**SAVE OVER \$10.00:** This kit  
**INCLUDES** the optional loudspeaker  
protector circuitry: **AT NO EXTRA CHARGE!**

**\$165<sup>00</sup>**

**DICK SMITH Electronics**

**SEE OUR OTHER ADS FOR FULL ADDRESS DETAILS**





# THE FEATURES OF \$1000 UNITS

The  
**DICK SMITH**  
professional  
Frequency counter  
**build yourself from \$99<sup>50</sup>!**

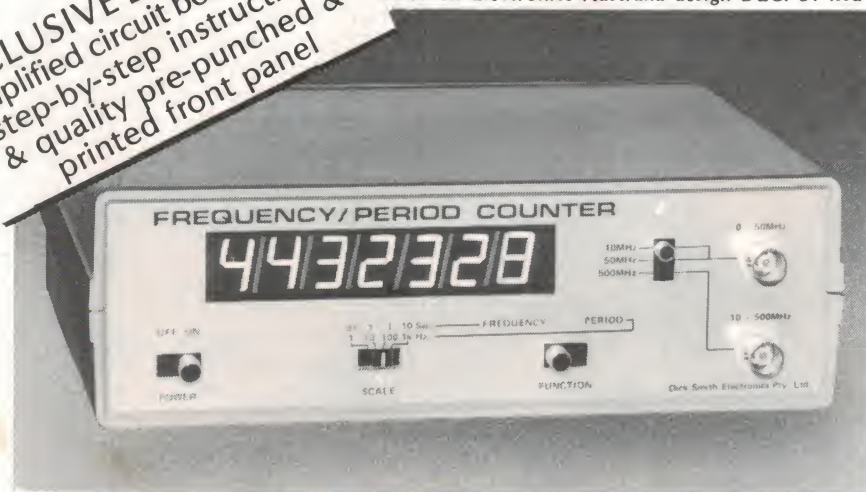
500MHz, 7 digit resolution plus  
period measurement feature.

A completely new frequency and period counter using the latest IC technology. The low component count makes it very reliable and easy to build. It will measure frequency to 500MHz (with optional pre-scaler) and period both with a 7 digit resolution. It rivals the performance of commercial units costing many times the price.

- Professional design and finish - uses high quality instrument case, ● Extremely easy to build - virtually no PC board wiring, and all switches are integral to the display board & front panel. An exclusive Dick Smith feature. ● Pre-punched & screened front panel, no drilling or filing required. ● Huge, bright high efficiency 7 segment display. ● 3 Frequency ranges - 0-10MHz, 0-50MHz, 10-500MHz (with optional pre-scaler), ● 4 Gating times - .01, .1, 1, 10 seconds. ● 4 Period measuring ranges: 1, 10, 100 and 1000 input cycles to give a 0.1uS resolution. ● High input sensitivity - 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75ohms input impedance, ● High accuracy - typically better than .005%±/count uncalibrated.

Based on Electronics Australia design DEC. 81 issue.

With  
**EXCLUSIVE DICK SMITH**  
Simplified circuit board wiring,  
step-by-step instructions &  
& quality pre-punched &  
printed front panel



Basic 50MHz Kit Cat. K-3439 **\$99.50**

Deluxe Instrument Case Cat. K-2505 **\$19.95**

500MHz Pre-scaler Cat. K-3432 **\$29.95**

& it's covered by our 'Sorry Dick it doesn't work'  
guarantee - so get yours now!

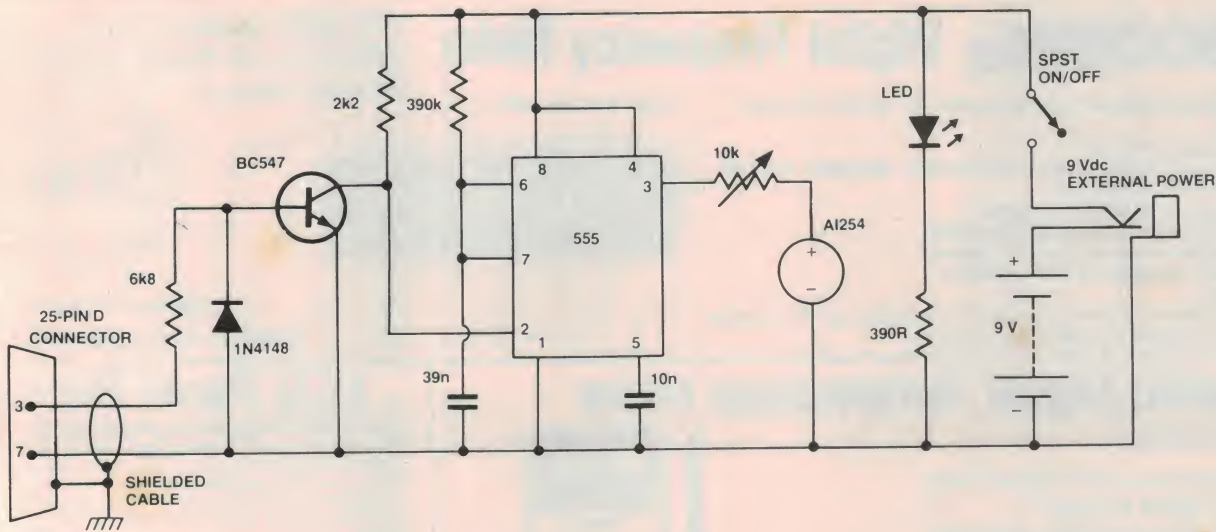
## DICK SMITH Electronics

NSW AUBURN 648 0558: BANKSTOWN SQ. 707 4888: BLAKEHURST 546 7744: BROADWAY  
211 3777: BROOKVALE 93 0441: CHULLORA 642 8922: GORE HILL 439 5311: NORTH RYDE  
888 3200: PARRAMATTA 683 1133: SYDNEY 290 3377: TIGHE'S HILL 61 1896:  
WOLLONGONG 28 3800 ACT FYSHWICK 80 4944 QLD BURANDA 391 6233: CHERMSIDE  
59 6255 SA ADELAIDE 212 1962: DARLINGTON 298 8977: ENFIELD (Opening soon) VIC  
MELBOURNE 67 9834: COBURG 383 4455: GEELONG (Opening soon): RICHMOND 428 1614:  
SPRINGVALE 547 0522 WA CANNINGTON 451 8666: PERTH 328 6944  
Mail Order Centre: PO Box 321, North Ryde 2113. Phone: (02) 888 3200 DSE A144RB





# Ideas for Experimenters



## RS-232 beeper

This circuit was devised to provide audio indication of data signals on an RS-232 interface, and was sent in by **Ian Hogan of St. Peters in South Australia.**

The device was built to provide audio feedback when using a digitiser table connected to a VDU. The time required to digitise a drawing is considerably increased if the operator has to continually refer to the VDU to ensure that a cursor key has registered correctly. Using this device, connected to the printer interface of the terminal, the operator can hear if the key has registered. Also, because the duration of

the sound is related to the length of the data string received, it is even possible to hear when a new prompt or error message is sent to the terminal.

The circuit operation is as follows: the 6k8 and 2k2 resistors, 1N4148 diode and BC547 transistor act as the RS-232 interface for the circuit. The 555 timer, 390k resistor, 39n and 10n capacitors form a monostable multivibrator.

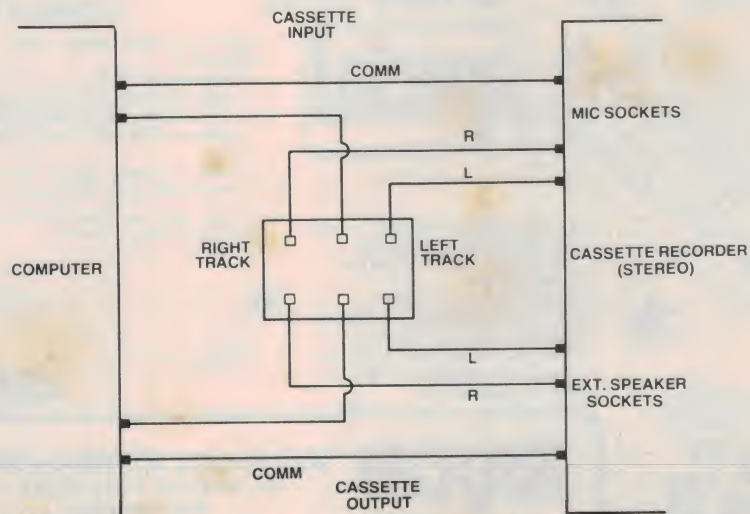
When no data signal is present, pin 3 of the D connector is between -5 and -25 volts with respect to pin 7 (signal ground), so pin 2 of the 555 is held high by the non-conduction of the BC547; hence the 555 is reset. When a positive-

going pulse occurs in a data stream, the BC547 conducts, sending pin 2 of the 555 low, thus triggering a pulse in the 555 output, turning on the AI254 audio indicator. The duration of the pulse is given by  $1.1 \times RC$ , where R and C are respectively 390k and 39n in this circuit.

The 10k potentiometer provides volume control of the audio indicator. The LED is simply for power-on indication. The external power socket allows a 9 Vac plug pack transformer to be used. The circuit was constructed on a small piece of Versa Strip board, and enclosed in a small zippy box.

## Double density computer cassette storage

This very smart idea came from **Murray Van Syn of Ardross in W.A.** By using a portable stereo cassette recorder for computer program storage, the program density can be conveniently doubled by employing all four tracks independently. A cheap DPDT switch, connected as shown, is used to select the appropriate track. Shielded wire is recommended for the interconnections.





# Quality Kits at Low Prices

## EA 500MHz Digital Frequency Meter

THE BEST QUALITY KIT  
VERSION OF THIS PROJECT  
IN AUSTRALIA

Other people may appear to be selling this kit for less. But you GET less!!!

Refer EA Dec 1981

Exclusive Jaycar features:

- Heavy gauge front panel. Pre-punched, anodised and silk-screened. (NOT Scotchcal)
- Low aging rate 10.000MHz crystal.
- Quality I.C. sockets provided. (A MUST)
- All metal film resistors used (1% 50ppm)
- Thermalloy heatsink for +5V regulator
- Tilting bail

Beware of advertised units that do not conform to the original design. They may have inferior performance.



50MHz Version \$119

500MHz option only \$26 extra

## Fantastic Digital Temperature Meter

Refer EA Feb 1982

Uses fantastic new LCD Display with all drive circuitry built-in!!

Build this simple and very accurate meter NOW!

**only \$59 inc case**



## ETI 330 Car Alarm

Fantastic car alarm that really works well and will not normally false trigger. This great kit has been held back by a shortage of the LM394 I.C. We have found a way of getting around this problem.

Complete kit in a die-cast box (less LM 394)

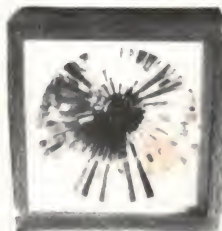
Refer ETI July 1981

**only \$19.50**

## disco strobe

NOT A KIT

Complete built-up unit. Housed in a smart cabinet made of wood. 0-12 powerful flashes / second. Just plug into a 240V power point.



**\$36.50**

## LCD Panel Meters

The illustration below shows the display with all segments and annunciators actuated. The unit is housed in a neat plastic escutcheon as shown in the illustration on the left. The DPM measures 72x36mm overall. Digital height 15mm (can be read at distances up to 10 metres).

Specs:

Input impedance: >100m  
Full scale reading: 199.9mV  
Accuracy 0.05% of reading +1 digit  
Power supply: 5-15VDC 50uA  
Sample rate: 3/sec  
Auto polarity, auto zero, over-range warning

Full data sheet supplied with each unit.



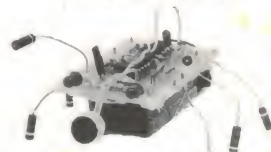
★ **DPM-200 ONLY \$39.50** ★  
case to suit \$5.50

## KISS A CUDLIP

Refer EA Feb. '82

All components up to PCB stage for this fun project.

**ONLY \$12.50**



## ★ POSITIONS VACANT ★

Our rapid expansion has created a demand for retail sales people. We are looking for young dynamic store managers who like to sell high quality merchandise.

If you currently work in electronics retailing and are not happy why not contact us?

We are only small but we're growing rapidly. You will start "Closer to the Top" with Jaycar because we are that much smaller.

If you want to know more ring me (in absolute confidence - of course) and we'll discuss things.

Gary Johnston

SHORT FORM  
KIT

## Ioniser Kits

COMPLETE

**special**

Based on the short form IONISER.

- redesigned PCB
- High efficiency emitter head
- Fits completely inside a high quality ABS box (not a metal lid)
- only 2-core mains flex protrudes from the box
- you can pay over \$80 for a built-up inferior unit!

- runs directly from 240V mains
- low power consumption
- produces high intensity electric field
- output around 7.5KV
- Will not necessarily produce ozone in standard form
- ideal for those who wish to 'try' an ioniser at an economical price



**\$45**

Normally  
~~\$24.50~~  
save **\$5**

**\$19.50**

**Jaycar**

380 Sussex St Sydney 2000

Ph. 2646688 Telex 72293

Mail Orders To:

Box K-39 Haymarket 2000

Post and Packing charges

\$5-\$9.99 (\$1) \$10-\$24.99 (\$2)

\$25-\$49.99 (\$3) \$50-\$99.99 (\$4)

\$100 up (\$5.50)

SHOP HOURS

Mon-Fri 9 to 5.30

Sat 9 to 3

Sun 10 to 2

Thurs night to 8pm





# Ideas for Experimenters

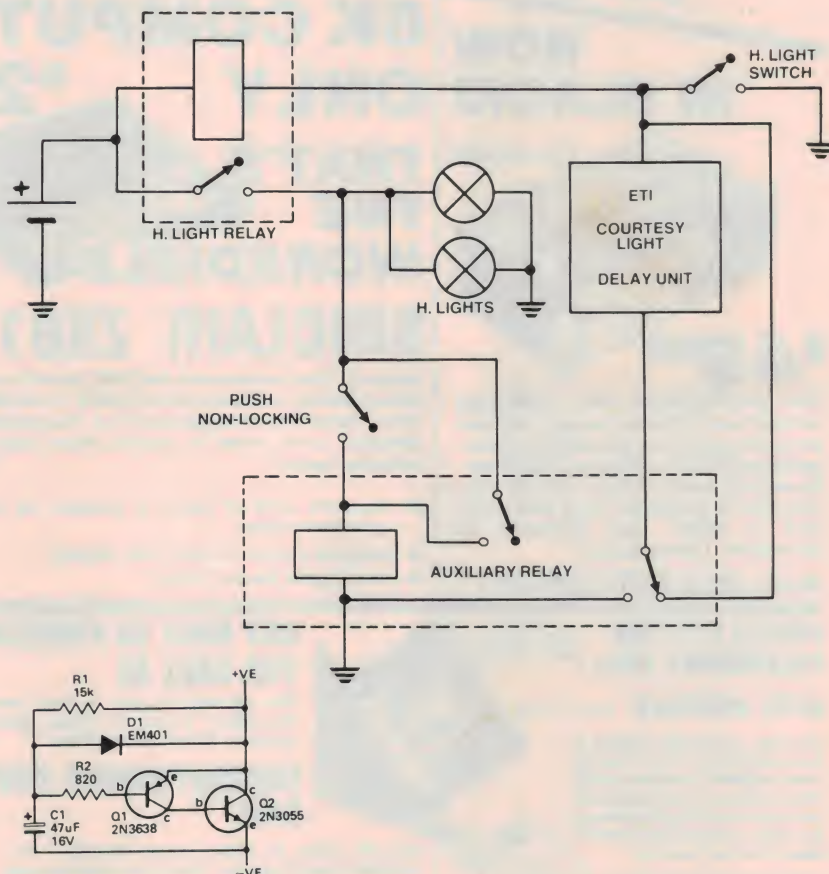
## Headlight delay

Ever driven home late at night and had to risk life and limb walking in the dark from the car to the house? Well, the problem is easily and cheaply solved by adding this circuit to your car, says **Stephen Mann of Forrestfield, W.A.**

The system is built around the ETI-232 courtesy light delay unit (or extender) from the October 1974 issue and Simple Projects Vol. 2.

Coupling this to the headlight relay as shown provides a particularly good turn-off delay for the headlights. Operation is simple. Whilst the headlights are still on, operate the pushswitch. The headlight switch may now be turned off and the delay unit and auxiliary relay will keep the headlights on. The length of time the headlights remain on is dependent on the value of C1 and the headlight relay dropout voltage.

The unit was installed on a Toyota Corolla and a value for C1 of about 300 uF gives a delay of about 60 seconds. The auxiliary relay is simply a 12 V type with double changeover contacts.



## ★ 'IDEA OF THE MONTH' CONTEST ★

Scope Laboratories, who manufacture and distribute soldering irons and accessory tools, have offered to sponsor a contest with a prize to be given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI. Each month we will be giving away a Scope Panavise pc board holder, model 333 — as described in News Digest, p.8; October '81 issue. Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, worth about \$70, each winner will be paid \$10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

### RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.



Winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

### COUPON

"I agree to the above terms and grant Electronics Today International all rights to publish my idea in ETI Magazine or other publications produced by them. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright".

\* Breach of copyright is now a criminal offence.

Title of idea .....  
Signature .....  
Name .....  
Date .....  
Address .....  
Postcode .....

Cut out and send to: Scope/ETI 'Idea of the Month' Contest, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.



**TAKE ADVANTAGE OF  
DICK SMITH'S**

**DIRECT**

**NOW  
IN BLACK!**

Cat. H-2481



**\$49<sup>95</sup>**

This professional rack mounting cabinet with heavy gauge chassis mounting plate is pre-drilled. Size: cabinet 42.5(l) x 25(w) x 140(d)cm. Beautiful matte black finish, this cabinet is supplied as a flat pack and it takes just minutes to assemble. Great value!

AVAILABLE END FEBRUARY

**8K COMPUTER  
ONLY \$249**

**THAT'S  
THE  
INCREDIBLE  
SINCLAIR ZX81**



Amazing! They've improved the ZX80, now it's the ZX81! It's more powerful, with even better BASIC — and the number of IC's is reduced to a staggering 4! Yes, the smallest personal computer in the world is available from Australia's No. 1 computer centre.

Cat. X-5000

- Complete with all leads to connect up your TV and cassette recorder.
- Supplied comprehensive user manual.
- Amazing 8K BASIC ROM!

**PRESS BUTTON  
TELEPHONE DIAL**

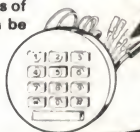
NOT  
TELECOM  
APPROVED

**with memory** Cat. Y-1175

Converts rotary dial phones to push button type. Ideal for private phone systems. memory re-dial allows a previously engaged number to be re-called at the press of a button. Up to 16 digits can be retained in the memory.

NORMALLY \$39.50

**NOW  
ONLY \$27**



**ZX80  
& 81  
OWNERS**

**NOT ONLY 30 PROGRAMS FOR  
THE ZX81 1K**

**\$12<sup>95</sup>**

This informative book features gambling games, educational programs, arcade games and utility programs. Challenge the ZX81!

Cat. B-2357

**UNDERSTANDING YOU ZX81  
ROM**

Just the thing for ZX81 owner! This book also includes a special section: 'How to use machine code routines in your BASIC programs.'

Cat. B-2361

**\$15<sup>95</sup>**

**NEW SOFTWARE**

**NEW BOOKS**

**VHF HANDBOOK**

This new, revised edition covers every important VHF subject in clear, concise language.

Cat. B-2300

**\$4<sup>50</sup>**

**SYS 80  
TRS 80  
OWNERS**

**AIR TRAFFIC  
CONTROLLER**

**\$12<sup>50</sup>**

Your task is to safely manoeuvre 26 aircraft between the two airports and various points within your 'area'. Working within a time limit makes it even harder! Cassette, requires 16K.

Cat. X-3681

**CRUSH, CRUMBLE AND CHOMP**

You are a huge marauding monster on the rampage, smashing bridges and buildings and creating havoc wherever you go! Cassette, requires 16K.

**\$29<sup>95</sup>**

**ASYLUM**

You are placed in a padded cell and your job is to find the way out: the use of ordinary commands will determine your ability to survive! Patience is a must! Cassette, 16 and 32K versions available.

**\$19<sup>50</sup>**

**SYSTEM 80 COMMUNICATION  
TERMINAL PROGRAM**

Use your System 80 to talk with other computers use local or overseas data bases, etc.

**\$9<sup>95</sup>**

Cat. B-2369

**\$9<sup>95</sup>**

**Sorcerer  
Owners**

**50 BASIC EXERCISES**

Learn BASIC through practice exercises, maths, business operations, research and games.

Cat. B-2363

**\$12<sup>95</sup>**

**\$65<sup>95</sup>**

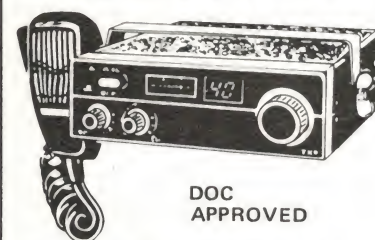
**SORCERER MUSIC PROGRAM**

This program includes software and assembled hardware, allows you to play a four-part harmony on your Sorcerer. Comes complete with sample tunes.

Cat. X-3603

**NOW  
LEGAL!**

**40  
CHANNEL**



DOC  
APPROVED

**STALKER XIII  
40 Ch AM/CB**

An AM CB radio with a full 40 CHANNELS! Easy to install and pushes a clean signal through the air. Great in emergencies or for making new friends! So join the CB rush now!

Cat. D-1447

~~\$149<sup>50</sup>~~ **\$97<sup>50</sup>**

**TE6000  
AM/SSB UNIT  
40 CHANNEL**



Cat. D-1709

This is superb SSB (Single Sideband) set. It has up to 3 TIMES the range of AM!!! Great CB value!

DOC  
APPROVED

**\$199**

**Why buy a  
superseded  
18 channel set?**



# IMPORT PRICES

## YOUR SYSTEM 80 CAN SPEAK!!!



### VOTRAX Type-'N-Talk™

**Exciting, new text-to-speech synthesizer** Cat. X-3290

Type-'N-Talk™, an important technological advance from Votrax, enables your computer to talk to you simply and clearly — with an unlimited vocabulary.

You operate Type-'N-Talk™ by simply typing English text and a talk command. Your typewritten words are automatically translated into electronic speech by the system's microprocessor-based text-to-speech algorithm.

Type-'N-Talk™ adds a whole new world of speaking roles to your computer. You can program verbal reminders to prompt you through a complex routine and make your computer announce events. In teaching, the computer with Type-'N-Talk™, can actually tell students when they're right or wrong — even praise a correct answer.

Type-'N-Talk™ has its own built-in microprocessor and a 750 character buffer to hold the words you've typed. Type-'N-Talk™ doesn't have to use your host computer's memory, or tie it up with time-consuming text translation.

Type-'N-Talk™ can be interfaced in several ways using special control characters. Connect it directly to a computer's serial interface. Then a terminal, or line printer can be connected eliminating the need for additional RS-232C ports on your computer.

Type-'N-Talk™ uses the least amount of memory and gives you the most flexible vocabulary available anywhere.

ALSO SUITS MANY  
OTHER COMPUTERS  
INCLUDING TRS-80

**ALL THIS  
FOR ONLY**

**\$525**

## WATCH THIS SPACE

**Did you miss out on our  
BELOW COST SPECIAL?**

Last month...  
**Kambrook 4 outlet power  
board (Cat P-5610)**

Normally **\$21.50**

Reduced to **\$11.35**

**SAVING \$10.15!!**

**This month? Call in and  
find out for yourself!**

## NEW METER!

- Auto ranging
- LCD Display
- Compare elsewhere for  
\$\$\$ more!

This superb new  
multimeter has just  
been added to our  
already large range.  
It has liquid crystal  
display and is auto  
ranging with a very  
low power consump-  
tion plus overload  
protection.



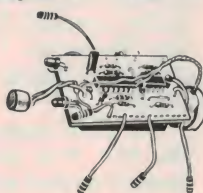
**\$49<sup>50</sup>**

Cat. Q-1446

## NEW KITS!

### CUDLIPP

(The Electronic Cricket)  
This interesting novelty kit  
reacts to external sounds by  
chirping back. Amuse your  
friends — confound your  
neighbours! Cat. K-3397



**GREAT FUN!**

**\$12<sup>50</sup>**

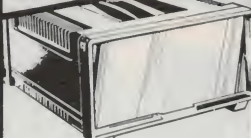
## NINE DIGIT DISPLAY

Great idea for kit builders,  
experimenters, etc. We've  
made a HUGE SCOOP  
PURCHASE of these  
superb LED displays as  
used in calculators, etc.  
Once sold for around \$20  
each: now look at our  
price!



**\$1<sup>50</sup>** Z-4155

## NEW CASE!



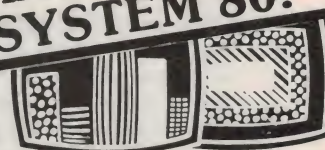
You'll go a long way to find a  
case as good as this one.  
Ideal for a huge range of  
projects, extremely well made  
looks a million dollars! But  
our low, low price?

H-2500

**\$19<sup>90</sup>**

## NOW COLOUR GRAPHICS FOR SYSTEM 80!

Cat.  
X-3275



This internally fitted option gives your  
System 80 a whole new dimension...  
**COLOUR!** It has the ability to display any  
of 8 different colours using a standard  
colour TV set or monitor. Colours are  
produced using a simple extension to the  
BASIC software — the CSET command.  
The PCB, with an additional cassette  
(including demo program) plus full fitting  
instructions are included. Go on: add a  
whole new world to your System 80!

AVAILABLE  
MID FEBRUARY

**\$129**

## Times Square Display



Imagine — a counter-sized moving letter  
display that can attract real attention!  
Unique computerised unit has 235 char.  
memory: you program the message you  
want with a simple keypad and away it  
goes! And changing the message is just as  
easy! Operates from 240V, with battery  
memory back-up. Amazing technology!  
Cat Y-1020

Expected this  
month: just ask!

**\$250**

## A 9V SIZE NI-CAD!



You asked for it! A 216 size battery to suit  
your 9 volt equipment. Many other sizes  
are available. Great value! Cat. S-3306

**\$10<sup>95</sup>**

## ECONOMY SIGNAL INJECTOR

Q-1270

Just the thing for  
troubleshooting audio  
circuits. Battery op.,  
fully self cont.  
A must for every  
hobbyists toolbox!

**\$7<sup>50</sup>**



## DICK SMITH Electronics



You'll find all our stores and resellers listed on  
another page of this magazine!



# Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here.

## ETI-492 Sound Bender

None of the components for this project should be difficult to obtain. The XR2206 function generator IC is widely stocked — even in Dick Smith stores! — and most kit and component suppliers have indicated they will be stocking the

project as a kit or stocking pc boards, the rest of the components being stock lines.

If you require an audio amplifier to drive a speaker, then we suggest you use our ETI-453 General Purpose Amplifier module. This is also known as the HE105 Bench Amplifier, from Hobby Electronics, and is widely available as a kit for around \$10. Try Jaycar in Sydney, All Electronic Components and Rod Irving in Melbourne or Altronic in Perth.

For those assembling the 492 and/or the 453 from parts on hand, then pc board suppliers were listed on page 63 of the January issue.



## WELL, BLOW ME DOWN!

This Sunon rotary fan from Dick Smith Electronics is designed for power supply and transmitter systems, but its uses are as limited as your imagination, so they say.

The fan, cat. no. Y 8500, is 110 mm in diameter and is fixed with four mounting holes and can be mounted either internally or externally. The seven plastic fan blades are encased in metal for rigidity.

It operates on 240 Vac and is available for \$16.90 from all Dick Smith Electronics stores.

## ETI-723 Selectacall

If you can't get 555s for this one, boy are you in trouble! Again, all parts should be readily available as most stores carry them as stock lines, the piezoelectric buzzer (Sonalert) included. No pc board was produced for this project, as explained in the article.

## ICs for Circuit Source Guide

A number of unusual ICs are specified in this feature so we have dug up supply sources to help those interested in lashing together some of the circuits. Firstly, there is a number of suppliers who stock a *wide* range of semiconductors — and if you're not familiar with them, you should be. In Melbourne, there's Ellistronics, All Electronic Components, Rod Irving Electronics, Radio Parts and Tasman Electronics. In Sydney there's Applied Technology, Radio Despatch Service and Electronics (Distributors). Note also that VSI stock a wide range of semiconductors from the major manufacturers, and they're in Adelaide, Brisbane, Melbourne, Perth and Sydney. Sorry, but there's just not enough space to list all the addresses and phone numbers here. Look in your local phone book.

Fine, now for some specific sources. This may not be exhaustive, but it's a starting point. The **LM331** and **RC4151** (p.16) are both stocked by Tasman Electronics. The **LM108/208/308** is widely stocked but if you have difficulty, try Applied Technology, Tasman and Rod Irving. Same goes for the **723** regulator. The **LF351** we understand is stocked by Rod Irving. The **LM3915** is widely stocked, and apart from those already mentioned you can try Jaycar and Altronics. The **CA3080** may be found at Radio Despatch Service, Rod Irving and Tasman. The National Semiconductor digital-to-analogue converter **DAC0800** is stocked by Rod Irving Electronics, but we don't know who else. The Analog Device's **AD536A** should be obtainable through Parameters Pty Ltd (02)439-3288 or (03)90-7444. The **ICL7106** is widely stocked — you can even get it through Dick Smith stores!



# ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131.

PCB PRICE					
ET 014	4.50	Dual Voltage Power Supply	Dec 71		
ET 043	2.00	Head or Tails	Oct 76	\$3.50	
ET 044	1.90	Two Tone Doorbell	Oct 76	\$4.50	
ET 047	1.90	Morse Practice Set	Dec 76	\$3.50	
ET 048	1.90	Buzz Board	Dec 76	\$3.50	
ET 061	2.20	Simple Audio Amp	Oct 76	\$3.50	
ET 062	2.50	Simple AM Tuner	Mar 77	\$3.50	
ET 063	2.50	Electronic Bongos	Nov 79	\$5.00	
ET 065	2.20	Electronic Siren	Dec 79	\$5.00	
ET 066	1.90	Temp Alarm	Dec 79	\$4.00	
ET 068	2.20	Led Dice	Oct 76	\$3.50	
ET 071	2.50	Tape Noise Limiter	Jan 79		
ET 072	1.90	Two Octave Organ	Jan 78	\$8.50	
ET 083	1.90	Train Controller	Dec 79		
ET 084	2.50	Car Alarm	Jan 77	\$12.00	
ET 085	1.90	Car over Rev Alarm	Oct 79		
ET 130	1.90	Temp/Volts Converter	Feb 76		
ET 132	2.90	Experimenter Power Supply	Feb 77		
ET 134	2.90	R.M.S. Voltmeter	Aug 77		
ET 135	2.50	Digital Panel Meter	Oct 77		
ET 136	2.50	Linear Scale Cap. Meter	Mar 78		
ET 137A	3.90	Frequency Meter Lcd	May 78		
ET 137B	3.90	Audio Oscillator	May 78		
ET 139	1.90	Power Meter	May 78		
ET 147	3.50	Electronic Dummy Load	Oct 80	\$36.00	
ET 149	3.50	2 Tone Generator	Jul 80	\$34.00	
ET 152	2.90	Capacitance Meter	Feb 80		
ET 157	4.50	Crystal Marker	Oct 81	\$34.50	
ET 158	3.50	Low Ohms Meter	Nov 81	\$29.50	
ET 159	2.90	10-15V Exp. Scale Voltmeter	Dec 81	\$23.00	
ET 245	2.90	White Line Follower	Nov 77		
ET 250	3.50	House Alarm (262)	Aug 80		
ET 255	2.90	Thermometer	Nov 80		
ET 256	2.90	Humidity Meter		\$19.50	
ET 258	2.50	Universal Relay Board	May 81	\$12.00	
ET 258	2.50	Mini Drill Speed Controller	Jul 81	\$ 8.00	
ET 258a		Versatile Incremental Timer	Jan 82	\$30.00	
ET 259b					
ET 260	2.60	Photo Lamin Flasher	Dec 79		
ET 261	2.90	Fog Horn	Dec 79		
ET 262	2.90	Intercom	Dec 79		
ET 263	2.90	Simple Egg Timer	Dec 79		
ET 264	2.90	Simple Siren	Mar 80		
ET 316	3.50	Transistor Assisted Ignition	May 77		
ET 317	3.50	Car Rev Monitor	Jul 77		
ET 324		Led Tacho	Aug 80		
ET 325	2.50	Car Auto Electric Probe			
ET 326	2.50	Exp. Scale Led Voltmeter	Spt 80	\$12.50	
ET 327	2.90	Turn/Hazard Indicator	Oct 80	\$22.00	
ET 328	2.90	Led Oil Temp Meter	Jan 81	\$15.50	
ET 329	2.50	Exp. Scale Vehicle Ammeter	Feb 81	\$18.00	
ET 330	3.90	Car Alarm	Jul 81	\$27.50	
ET 332	2.90	Electronic Stethoscope	Aug 81	\$34.00	
ET 333		Reversing Alarm	Jan 82	\$19.00	
ET 363	3.50				
ET 417		Overload Indicator	Aug 73		
ET 438	8.50	Led Level Meter		\$11.00	
EET 440	2.50	25 Watt Stereo AMP	Mar 75		
ET 445	2.20	General Purpose Preamp	Jul 76	\$8.50	
ET 446	3.50	Stereo Limiter	Jul 76		
ET 449	2.90	Mike Amplifier	May 77		
ET 450A	3.50	Bucket Brigade	Dec 77		
ET 450B	3.20	Bucket Brigade	Dec 77		
ET 452	2.90	Guitar Practice Amplifier	Jan 80		
ET 453	3.50	AMP Class B. Gen Purpose	Apr 80		
ET 454	3.50	Fuzz Box	Apr 80		
ET 455	3.90	Loud Speaker Protector	Mar 80	\$25.50	
ET 457	2.90	Scratch & Rumble Filter	Spt 80		
ET 458	4.90	Led Level Meter	Jan 81	\$27.00	
ET 459A	3.50				
ET 466	7.50	300W AMP Module	Feb 80	\$83.00	
ET 467	6.90	4 Input Mike Preamp	Jul 80	\$27.50	
ET 470	2.90	60 Watt Amp Module Series 4000	TPV 6	\$28.00	
ET 471	9.90	Audio Preamp Series 4000	TPV 6	\$45.50	
ET 472	2.90	Power Supply For Series 4000	TPV 6	\$24.00	
ET 473	5.90	Moving Coil Preamp Series 4000	TPV 6	\$54.00	
ET 474	2.90	Interface 60W Amp	Jan 80		
ET 475	4.90	AM Tuner	Spt 80	\$80.00	
ET 476	6.90	Series 3000 AMP 25W Stereo	Nov 80	\$84.00	
ET 477	4.90				

## SERIES 5000 POWER AMP COMPLETE KIT

ET 478MB	15.00	Series 5000 Preamp Main Board	Oct 81		
ET 478MC	3.90	Moving Coil Preamp (5000)	Spt 81	\$24.50	
ET 478MD	3.90	Moving Magnet Preamp (5000)	Spt 81	\$18.00	
ET 478SA	2.50	Series 5000 Preamp Switch Bnd	Oct 81		
ET 478SB	1.90	Series 5000 Preamp Switch Bnd	Oct 81		
ET 478SC	1.90	Series 5000 Preamp Switch Bnd	Oct 81		
ET 478SD	1.90	Series 5000 Preamp Switch Bnd	Oct 81		

## SERIES 5000 PREAMP COMPLETE KIT

ET 480	2.90	50 Watt Amp Module	30 Ap	\$17.50	
ET 480	2.90	100 Watt Amp Module	30 Ap	\$22.00	
ET 480PS	2.90	50-100 AMP Module Pwr Supply	30 Ap	\$22.50	
ET 481M	2.75	Hi-Power P.A./Guitar Amp Mod.	30 Ap		
ET 481PS	4.90	12V/100 P.A. Inverter	30 Ap		
ET 483	3.90	Sound Level Meter	Feb 78		
ET 484	4.90	Expander Compressor	Jul 77		
ET 485	4.50	Graphic Equaliser	Jan 77		
ET 486	3.90	Howl Round Stabilizer	Nov 77		
ET 489A	3.50	Audio Spectrum Analyser No2	Apr 78		
ET 489B	3.50	Audio Spectrum Analyser No2	Apr 78		
ET 496		Series 4000-1 Speaker Kit	Feb 80	\$820.00	
ET 528	2.90	Intruder Alarm	Jan 75		
ET 539	2.90	Touch Switch	Mar 76		
ET 541	2.90	Train Controller	May 76		
ET 547	3.50	Telephone Bell Extension	Jan 77		
ET 549A	2.90	Metal Detector	May 77		
ET 560	1.90	240V Mains Locator	Mar 80		
ET 561	2.90	Metal Detector	Apr 80	\$34.00	
ET 563	3.90	Geiger Counter	Jul 80	\$54.00	
ET 563	3.90	Nicad Fast Charger	Jul 80		
ET 566A	2.90	Pipe & Cable Locator	Apr 80		
ET 566B	3.90	Pipe & Cable Locator	Apr 80		

ET 567	3.50	Core Balance Relay	Apr 81	\$42.00	
ET 568	2.90	Photo Flash Trigger	Oct 80	\$25.00	
ET 570A		Infrared 'Tnp' Relay TX	Jan 82		
ET 570b		Infrared 'Tnp' Relay RX	Jan 82		
ET 572	4.90	Digital PH Meter	Dec 80	\$86.50	
ET 573	3.50	Universal Timer	Oct 79		
ET 576	5.90	Electronymogram	TPV 6	\$38.00	
ET 577	3.50	General Purpose Power Supply	TPV 6	\$38.50	
ET 578	2.90	Simple Nicad Charger	Jan 80		
ET 581	2.50	15V Dual Power Supply	Jan 80	\$8.50	
ET 583	2.90	Marine Gas Alarm	Aug 77		
ET 585R	1.90	Ultrasonic Receiver	TPV 6	\$18.95	
ET 585T	1.90	Ultrasonic Transmitter	TPV 6	\$8.95	
ET 585	3.90				
ET 591A		Up/Down Digit Counter	Jul 78		
ET 591B		Up/Down Digit Counter	Jul 78		
ET 596	2.90	White Noise Generator	Nov 81	\$8.00	
ET 598		Touch Switch	Feb 81	\$10.00	
ET 598B	2.50	Touch Switch	May 80		
ET 599A	2.50	Infr Red Remote Control TX	Aug 81		
ET 599B	2.50	Infr Red Remote Control	May 80		
ET 599C	2.90	Infr Red Remote Control	May 80		
ET 599D	2.20	LR Remote Cntrl Power Supply	May 80		
ET 603	4.90	Music Synthesizer Sequencer	Aug 77		
ET 604	604	Metronome	Spt 77		
ET 606	3.90	Electronic Tuning Fork	Nov 79		
ET 607A	2.90	Sound Effects Generator	Aug 81		
ET 607mf	2.90	Sound Effects Generator	Aug 81		
ET 607rf	2.90	Sound Effects Generator	Aug 81		
ET 631-2	7.50	Keyboard Encoder	Apr 77		
ET 635	3.90	Train Steam Whistle	Apr 81		
ET 636	16.90	7 Slot S100 Mother Board	May 80		
ET 637		Cassette Interface	Jan 78		
ET 638A	4.90	Eprom Programmer	Jul 78		
ET 640	65.00	Memory Mapped VDU		\$149.00	
ET 650A	4.50	Stac Timer	Nov 78		
ET 650B	4.50	Stac Timer	Nov 78		
ET 650C	4.50	Stac Timer	Nov 78		
ET 660	19.00	Learnners Microcomputer	Oct 81	\$99.00	
ET 661		Key Set (18) To Suit ET660		\$30.00	
		Colour Option Kit To Suit 660		\$14.50	
ET 682	69.00	Versatile Eprom Card	Mar 81	\$115.00	
ET 708	2.90	Aerial Amp	Mar 76		
ET 713	4.90	FM Tuner add on	Spt 77		
ET 717	4.50	Crosshatch Generator	May 78		
ET 726	3.50	R.F. Amp 70W 6/1C Meter	Feb 80	\$36.00	
ET 729		UHF TV Masthead amp	Apr 81	\$37.50	
ET 730		UHF TV Converter	May 81		
ET 731	4.50	Teletype Modulator	Oct 79		
ET 735	3.90	UHF to VHF Converter	May 81		
ET 760	2.50	Video Mod. To Suit 660 Micros	Spt 81	\$14.50	
ET 764	2.90	Slot Car Power Supply	Dec 81	\$19.00	
ET 825	5.90	Slot Car Controller	Dec 81	\$70.00	
		Without Case		\$55.00	
ET 1501A	2.50	Negative Ion Generator	Apr 81	\$39.00	
ET 1501B	2.50	Negative Ion Generator	Apr 81		
ET 1501C	1.50	Negative Ion Generator	Apr 81		
ET 1503	3.90	Battery Charger	Aug 81		
Dream 6800	12.50			\$100.00	
Dream 6802	12.50			\$100.00	
Power Supply to Suit Dream Micro Kit				\$29.50	
HEX Keypad 19 keys				\$29.50	
75CD7	3.50				
75L11	2.50				
76E04	1.00				
76PC9	5.50				
78TMB	2.90				
78C5	4.90				
78A06	3.90				
78N6	3.50				
78T3	4.50				
78NG4	2.90				
78U74	4.50				
78U10	9.50				
79SB10	3.90				
79FC11	2.50				
79F09	3.90				
79SE3	3.90				
79T11	2.90				
79PS11	2.90				
79PC12	2.90				
79SF10	2.50				
79SF9	2.90				
79UPS6	2.50				
80ST10A	3.50				
80ST10B	3.50				
80TC12	2.90				
80CM3A	4.50				
80CM3B	2.50				
80PG6	6.50				
80TV8	3.90				
80F3	3.20				
80PP3	2.50				
80LL7	2.90				
80B17	2.50				
80BM10	2.90				
80SA10	9.90				
80DC10	6.50				
80GA12	6.50				
80HLA5	2.90				
80LS12	3.50				
80LBR12	2.50				
80MA4	2.50				
80PC4	2.50				
80HSS6	2.90				
80PC7	3.50				
80FB12	2.90				
80G6	5.90				
80GPS3	2.90				
80AD12	3.00				
80AU3	3.50				
80A9A	4.50				
80TMA8	5.90				
80TMB8	5.90				
80PPTA	6.50				
80PPTB	6.50				

80RF5	2.90	Rumble Filter	May 80	
80RM12	2.90	Cylon Voice Simulator	Dec 80	<b>\$18.50</b>
80SA3	4.90	Playmaster Stereo Amp.	Mar 80	????
80CH7	6.50	240 V.A.C. Light Chaster	Jul 80	
80RAM12	3.90	Ram Expansion for Dream	Dec 80	<b>36.00</b>
80PA6	7.50	Playmaster 300W amp. Module	Jun 80	<b>\$63.00</b>
80CL4	3.50	Time Controller	Apr 80	
80TRS11	2.90	TRS 80 Printer Serial In.	Nov 80	<b>\$15.00</b>
81DC2	2.20	Le Gong Doorbell	Feb 80	<b>\$15.00</b>
81DT5	3.00	Dream Tape Controller	May 81	
81GA3	11.50	Colour Graphic Analyser	Mar 81	<b>\$36.00</b>
81UC8	4.50	Universal Timer and Stopwch.	Aug 81	
81MP6	2.90	Microprocessor Power Sup.	Jun 81	
81IRA4	4.50	Infra-Red Relay	Apr 81	<b>\$36.00</b>
81IR4B	2.90	Infra-Red Relay	Apr 81	
81SP1	2.90	RS232 TRS80 System 80 In.	Jan 81	
81S13	7.90	TRS80/System 80 Serial In.	Mar 81	
81SW1	2.90	Moving Coil Preamp	Jul 81	
81MC7	2.90	Analogue/Analog Store. Crd.	Feb 81	
81RM2	2.50	Analogue/Analog Store. Crd.	Mar 81	<b>\$100.00</b>
81DC3B	8.50	Wind Speed Indicator	Oct 81	
81DC3A	9.50		Mar 81	<b>\$43.50</b>
81WS10	2.90		Oct 81	<b>\$43.50</b>
81P6	2.90	Pool/Lotto Selector	Jun 81	<b>\$24.50</b>
81AD10	3.50	Audio Test Unit Cass.Deck	Oct 81	
81A010	3.50	Audio Test Unit Cass.Deck	Oct 81	<b>\$47.50</b>
81MC8	9.50	Musicalcorder IV	Aug 81	<b>\$78.00</b>
81SG9	4.20	Lead Sandglass	Sep 81	<b>\$22.50</b>
81P19		Digital Clock Thermometer	Sep 81	<b>\$80.00</b>
81C19		Slide Cross Fader	Sep 81	<b>\$80.00</b>
81GA9	3.90	Photon Torpedo Game	Nov 81	<b>\$23.50</b>
81UC8		Universal Timer	Aug 81	
81MC7	9.50	Moving Coil Preamp	Sep 81	
81SW7		Train Steam Whistle	Jul 81	<b>\$17.50</b>
81SM7	2.90	Bagatelle	Jul 81	
81VM2	9.50	High Impedance DC Voltmtr	Feb 81	
81HBA4	7.50	Heart Rate Monitor	Apr 81	<b>\$84.00</b>
81HBA9	2.90	Heart Rate Monitor	Apr 81	
81MA4	2.50	Touch Sensitive Alarm	Apr 81	
81RCA4	3.50	Infra Red Remote Control	Apr 81	
81RCA8	2.50	Infra Red Remote Control	Apr 81	
81RCA4	2.75	Infra Red Remote Control	Apr 81	
81SP5	2.50	Sound Pressure Meter	May 81	<b>\$37.00</b>
81OR7	9.50	Electronic Organ	Jul 81	<b>\$58.00</b>
81C12	3.50	Christmas Decoration	Dec 81	<b>\$15.00</b>
81fm10a	4.90	500MHZ Digital Freq.Mtr.	Dec 81	<b>\$135.00</b>
81fm10a	4.90	500MHZ Digital Freq.Mtr.	Dec 81	<b>\$135.00</b>
81fm10b	3.50	500MHZ Digital Freq.Mtr.	Dec 81	
81d12	3.90	Lab Bar Graph Display	Dec 81	
82ep1	3.90	Easy to use Eprom Programmer	Jan 82	<b>\$20.00</b>
82ep1	7.90	With Plugpack	Jan 82	<b>\$51.50</b>
81m1l	2.50	Metronome (Low Current)	Jan 82	<b>\$19.00</b>
81wd12a	2.50	Wind Direction Indicator	Jan 82	<b>\$24.50</b>
81wd12b	2.50	Wind Direction Indicator	Jan 82	



## JIL SX-200, A BETTER SCANNING MONITOR RECEIVER.



Monitors over 33,000 frequencies from 26 to 88 MHz, 108 to 180 MHz and 380 to 514 MHz. Bands included within this range are HF and UHF CB, 27 and 155 MHz MARINE, Australian LOW BAND, AIRCRAFT band, VHF SATELLITE band, 10 Mx, 6 Mx, 2 Mx and 70CMx AMATEUR BANDS, VHF High BAND as well as UHF two-way band.

Mechanically rugged the SX-200 uses high quality double-side Epoxy-Glass printed circuit boards throughout. Some of its other outstanding features include 3 MODE SQUELCH circuitry which allows the lockout of spurious and carrier only signals, extremely low spurious count, AM and FM detection on all bands, FINE TUNING control for off channel stations, 240 VAC on 12 Volt DC operation, Accurate QUARTZ CLOCK, Squelch operated OUTPUT for switching a tape recorder etc, 16 Memory channels, MEMORY BACKUP which lasts up to two years, high SENSITIVITY and SIGNAL TO-NOISE ratio on all bands, CRYSTAL FILTER for excellent SELECTIVITY and easy servability due to component layout as well as a 90 day warranty.

Its high quality and performance is testified by the fact that it is in use by a large number of State government and Federal bodies including most state and federal police departments.

Contact GFS, the Australian Distributors, or our interstate outlets for full technical specifications.

We also market a range of pocket scanning receivers and transceivers. Contact us for full details.

PRICE \$512 INCL S.T. + \$8 P&P  
SERVICE MANUAL \$10 + \$1 P&P  
SCAN-X BASE ANTENNA \$48 + \$8 P&P

Interstate Dealers;  
WA; (09) 387 4966  
NSW; (02) 211 0531  
QLD; (07) 397 0808  
SA; (08) 269 4744

**GFS Electronic Imports**  
15 McKeon Road  
Mitcham, 3132 Vic  
TLX 38053 GFS  
(03)873 3939

## ELECTROCRAFT will put you in the picture



IDEAL FOR:  
CARAVANS,  
BOATS AND  
CAMPING  
TRAILERS

### A BREAKTHROUGH IN TELEVISION AERIALS

The rugged construction, super strong anodized elements and weather tight Cylolac housing makes it durable in all kinds of weather. Does not require elaborate mounting hardware, yet Sensar installations are stronger than that of conventional antennas with comparable performance. Unique bi-directional characteristics of Sensar antennas provide excellent reception in areas where stations are in different directions... eliminates the need for an antenna rotor in most locations. Reception is excellent... up to 40 miles over land... much, much farther over water. Provides VHF/UHF/FM-AM reception.

### KIT INCLUDES:

SR-20M for 12-volt operation. Includes antenna with built-in solid-state preamplifier and anodized aluminium elements, SBP-20 12-volt battery adaptor, MSJ-5 band separator with TV set cord, 15ft 75ohm coaxial cable with connectors.

Push up antenna mast, mast brackets, clamps, screws, instruction sheet supplied.

We have the largest selection of T.V. Aerials in N.S.W.

*Phone the Specialists for  
your antenna problems, we  
will help you to receive  
good pictures or good  
sound.*

**ELECTROCRAFT** PTY LTD

68 Whiting Street, Artarmon N.S.W.

Telephone 438-4308 (ext. 6)

or 438-3266 (ext. 6)

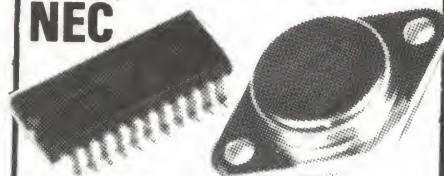
WE ARE SPECIALISTS  
30 years in the antenna business.  
Hours: 8am to 5pm.

*Prices subject to alteration without notice.*

## I M A R K for JAPANESE ICs & TRANSISTORS

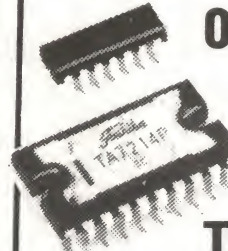
OEM Quantity prices available

**NEC**



**SANKEN**

**OKI**



**TOSHIBA**



**HITACHI**

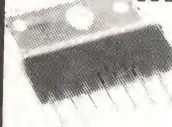


**SANYO**

**MITSUBISHI**



**MATSUSHITA**



**FUJITSU**

Send for price list

**I M A R K**

PTY. LTD.

167 Roden St., West Melbourne,  
Victoria 3003

Phone: (03) 329 5433 Telex AA37753





## Russian 'robot birds' in orbit!

The six Russian satellites, RS3 through RS8, reported here in the January issue, were launched on December 17 and are now in a nearly circular orbit around the Earth at an average altitude of nearly 1700 km.

**The six are steadily moving away from each other with slightly different orbits, and by December 28 their equatorial crossing times were spread over more than an hour and their crossing points over nearly 20 degrees.**

All six have been transmitting telemetry data, with each series preceded by the spacecraft's call (e.g. 'RS3'). RS3, 5 and 7 all have 'robot transponders', and at least one has been worked by a number of stations around the world.

Robot availability is indicated by a 'CQ', stopping when a signal appears in its input passband. Sending (for example) 'RS5 de VK2ETI AR' should bring the response 'VK2ETI de RS5 QSO nr xxx'. It may also respond 'QRZ', 'QRM', or 'RPT' if it misses a call, or 'QRQ' or 'QRS' to calls made below or above its 10-25 wpm acceptance range.

Beacon frequencies for the even-numbered birds are: RS4, 29360/29403 kHz; RS6, 29411/29453 kHz; and RS8, 29461/29502 kHz. Their 40 kHz-wide OSCAR-style transponders have apparently not yet

been activated. One indication of transponder status in any of the six is the first, or 'K', group telemetry number, which indicates power output. A reading of anything other than 'K00' should mean the transponder is on.

Interference to the RS satellites from terrestrial stations is becoming a real problem, with their covering so much of the 29.3 to 29.5 MHz spectrum. SSB, AM and FM signals have all been heard in recent weeks on top of or breaking over onto the new satellites. Non-satellite users should try to stay below 29.3 MHz or above 29.5 MHz to avoid the problem.

OSCAR 9 is still in its test phase, but all problems with the command station have been remedied. All testing should be concluded by mid-January, when experiments should begin.

Ariane was launched successfully on December 20 from French Guiana, with no problems reported. This should clear the way for the L5 launch in the spring, and L6 (with the AMSAT Phase 3A bird aboard) on July 6. (Thanks to HR Report).

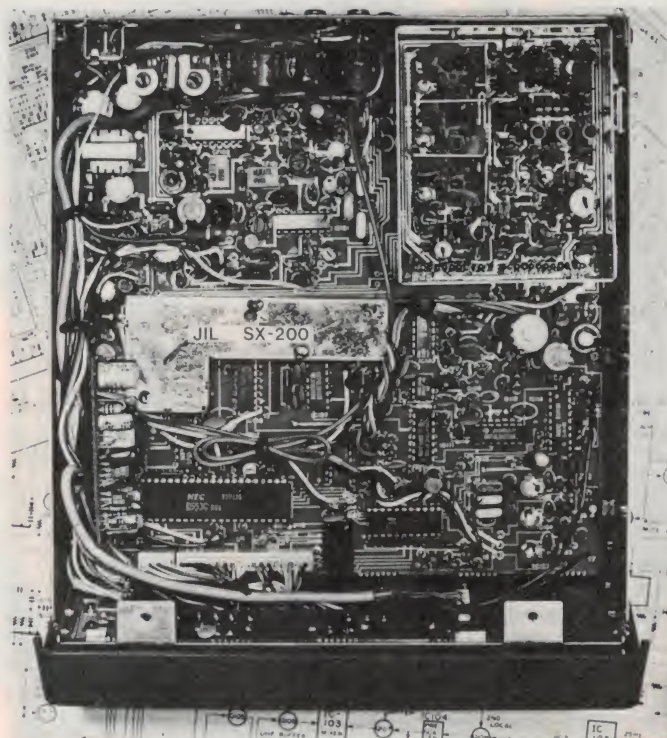
## 24-hour quartz world clock

**Know the time anywhere in the world at a glance! The new Yaesu 24-hour quartz world clock, available from all Dick Smith stores, enables you to do just that.**

It is ideal for anyone who makes international phone calls, giving you the time in any city in the world at a glance, and for amateur radio enthusiasts — no more guesswork when trying to contact people overseas.

The clock has a simulated walnut finish and can be hung on the wall or used with its supplied stand. Cost is \$49.50.

The Yaesu 24-hour world clock uses one 'C' cell battery (supplied) and is quartz-controlled for accuracy.



## Scanner manual

**GFS Electronic Imports of Mitcham, Victoria, Australian distributors of the JIL SX-200 HF/VHF/UHF programmable scanning receiver, recently announced the availability of a comprehensive Service Manual for that unit.**

The SX-200, a keyboard-entry programmable scanning receiver covering 26-88, 108-180 and 380-514 MHz, owes most of its performance and flexibility to a 4-bit microprocessor which has its own on-board ROM and RAM. Extensive use is made of CMOS LSI phase-locked loops plus shift registers, counters, etc. JIL recognised that such sophistication made it almost mandatory for personnel servicing the SX-200 to have available to them well laid-out and comprehensive service details.

To cater for this JIL have

produced the SX-200 Service Manual, which includes block diagrams, circuit diagrams, wiring diagrams, printed circuit board layouts (both sides), component list, alignment procedure, list of voltages for each IC and transistor, as well as a wealth of other useful service information.

The manual is available from GFS Electronic Imports, 15 McKeon Road, Mitcham Vic. 3132, (03)873-3939, or their distributors in various states. Price is \$10 plus \$2 post. For further information on this or the SX-200 contact GFS.

## Club Call

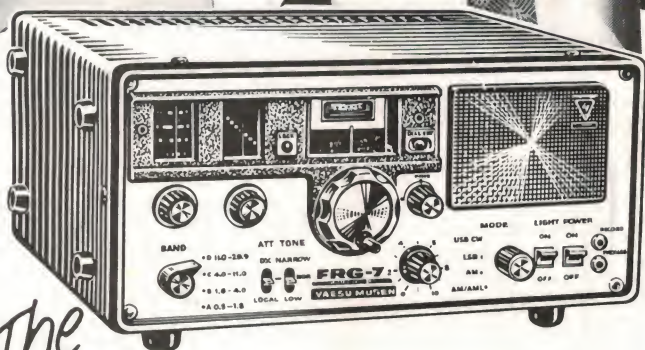
The **Keilor Radio Amateur Group (KRAG)** serves the western suburbs of Melbourne, and meets on the second Thursday of every month. Meetings are held at the Keilor Heights High School in Quinn Grove, East Keilor, starting at 7.30 pm. New members are welcome, and are invited to address all enquiries to P.O. Box 122, Avondale Heights Vic. 3034.

The **Townsville Amateur Radio Club** recently held its annual general meeting, and the office bearers for 1982 include Roger Cordukes (VK4CD), President; Bill Sebbens (VK4XZ) and Peter Renton (VK4PV), Vice Presidents; Don Bowman (VK4ZY), Secretary; and Ken Telford (VK4ZOC), Treasurer. During 1981, membership rose from 58 to 86, mainly due to good enrolment in the novice instruction class. You can contact the club through the Publicity Officer, Peter Renton (VK4PV) on Townsville 71-9211 (bh), 72-1236 (ah).





*66* MY CHOICE OF  
**BEST**  
MUST BE THESE  
UNITS *99*



*The  
ever  
popular*

**FRG 7**

0.5/30 MHz Receiver

**20,000km RANGE!**

The most widely used communications receiver IN THE WORLD! Yaesu's famous FRG 7 covers all MF & HF bands (from 500kHz through to 30MHz) with outstanding selectivity and sensitivity. It uses the famous 'Wadley Loop' principle for superb stability. And now you can really save with the FRG 7! Our huge bulk buying has enabled us to slash the price! But hurry. This special price can only last for the current shipment.

Cat.No D 285G

**NOT \$395**

**STILL  
ONLY**

**\$359**

**SAVE \$40**



*The brilliant  
new*

**FRG 7700SW**

If you want the most up-to-date shortwave communications receiver in the world, you want the Yaesu FRG 7700 SW. Complete short wave coverage with ease of operation the others only dream about.

- Digital frequency display (also shows the time!)
- One dial pre-selector
- Timer for recording etc.
- Optional memory unit for instant popular frequency recall (up to 12 channels)
- Can be operated from 12 volts DC (240V AC normal)

If you're serious about short wave monitoring, you can't go past this superb piece of solid state craftsmanship.

Cat.No D 2841

**ONLY**

**\$499**

Optional memory unit: Store and instantly recall up to 12 channels.

Cat D 2842 ..... \$149.50

Optional Antenna Coupler/Attenuator. Get the most from your receiver.

Cat D 2843 ..... \$71.50



# VALUE OUTSTANDING

Dick Smith

the brilliant  
**YAESU FT-ONE**



No longer in the "luxury" category, Yaesu's new FT-ONE is very affordable - especially when compared to other general coverage transceivers. The FT-ONE — a transceiver that commands the bands! Buy your Yaesu from Dick Smith Electronics: Australia's leading factory-approved Yaesu agent .. the ones who give you a full 12 month guarantee AND guarantee to match or better any genuine Yaesu price offered by other suppliers.

## look at these features . . .

- ALL mode — even FM\* — so you can 'go anywhere' — on its own, or teamed up with a transverter. It's brilliant!
- ALL band — it receives from 150kHz to 30MHz continuous, with resolution down to 10Hz! And the transmitter includes all the new WARC bands.
- ALL microprocessor controlled — which makes operation nice and easy for you (including keeping track of the FT-ONE's 10 memories!)
- ALL area operation: run it from 100-120 or 200-240V AC in the shack, or 13.5V DC when mobile!
- ALL solid state (of course!) with a massive complement of 659 semiconductor devices, including over 70 IC's!
- ALL performance — with better than 0.3uV sensitivity and more than 100W PEP output (SSB).

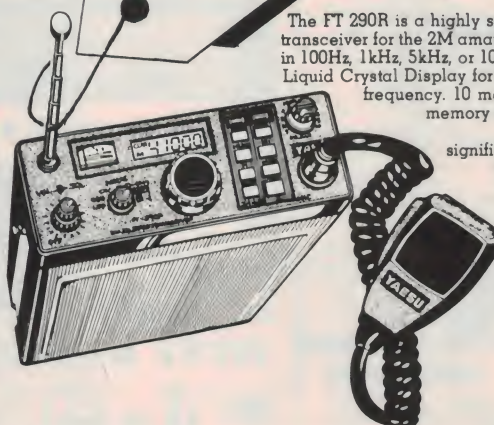
Cat. D 2852

\*FM is optional at extra cost.

Chosen by Dr David Lewis  
for the 1982 Antarctic  
Scientific Expedition

# \$1795

**NEW**



**NEW**

## FT 208R VHF Handy FM Transceiver

The Ft 208R transceiver brings a new flexibility to today's active 2M operator. An easy to read LCD display is coupled with a 4-bit microprocessor, bringing 10 memories & a scanning function.

Only with Yaesu can you get these features at such an economical price. Check it out NOW!

\*Price includes charger!

Cat.D 2889

# \$368

## 2 METRE PORTABLE FT 290R

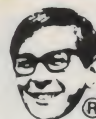
The FT 290R is a highly sophisticated compact multimode transceiver for the 2M amateur band. Featuring PLL synthesis in 100Hz, 1kHz, 5kHz, or 10kHz steps. The FT-290R utilizes a Liquid Crystal Display for digital readout for the operating frequency. 10 memories, scanning of the band or memory channels, two VFO's & receiver offset tuning makes a significant breakthrough in technology. So be quick, these are not going to last! Don't miss out!

Cat.D 2885

# \$395

DSE/A160/PAI

## DICK SMITH Electronics



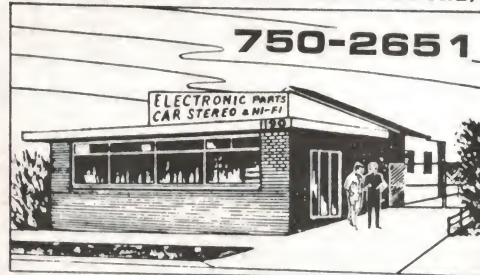
See our other ads for address details





# FABULOUS FEBRUARY SAVINGS

1190 CANTERBURY RD,  
PUNCHBOWL, NSW 2196  
(NEAR ROSELANDS SHOPPING CENTRE)



**ROTATING EMERGENCY LIGHT**  
**\$25**  
12v DC OPERATION WITH CAR CONNECTOR CORD. WERE \$29



**12V DC ROTARY SOLENOID STEPPING SWITCH**  
U.S.A. Made!  
**\$19.99**  
12 POSITION, SINGLE POLE, SHORTING.

**IC's**

"SWEEPINGS OFF THE FACTORY FLOOR"  
Approx 100 ASST. FOR **\$11.50** 1000 for **\$100**

**UNIVERSAL VIDEO MONITOR**

12" Black and White TV can be changed at the flick of a switch to a high resolution VIDEO MONITOR for use with most computers. Operates on 12V DC/240V AC for portable use. Usually \$149 NOW SAVE \$20 AT THIS SPECIAL PRICE! **\$109**

**TV PCB'S**

From AWA, these new circuit boards have over 80 parts incl. 8 trans. (25C1014, 25C711, 25A673, 25A628, 25C620), 10 diodes, caps, resistors, trippots, etc. GREAT VALUE HERE!



**Push-Button TUNER BOARDS**  
Comprises 2 boards, one has 8xDPDT push-button switches, similar to Isostat - the other has 8x100K multi-turn trippots with 3 position band-change switches. LTO, QTY. **\$3** EACH 10 For **\$25**

**MUSICAL PUSH-BUTTON PHONE \$49**

NEW MODEL WITH MUSIC GENERATOR AND MUTE Hand-held with MEMORY for last number REDIAL, fitted with a Telecom plug but currently not approved. WERE \$65.00!

**MINI-TOGGLE SWITCHES**

A. ON-OFF standard 90¢  
B. ON-(ON) momentary 80¢ SPDT  
E. (ON)-OFF-(ON) mom. 70¢ (3P)  
F. ON-OFF standard \$1.35  
G. ON-(ON) momentary \$1.00 DPDT  
J. (ON)-OFF-(ON) mom. 90¢ (6P)

## INCREDIBLE TRADE-INS

**CAR STEREO**

**40 CHAN. CB NOW AVAIL.**

**COMPARE OUR PRICES** before you buy

**transceivers**

**PRESIDENT GRANT 40 Chan \$279**  
INCL. TOP-QUALITY AERIAL AND BASE, LEAD ETC. PLUS SWR METER.

**HEADSETS WITH MIC**

from SONY **\$25**  
Electret Condenser Microphone

**WEATHERPROOF ANTENNA BASES**

for all Australian made HF communications aerials - ensures good ground contact - rugged and reliable - easy to install on cars, boats, etc. Usually \$4.50, SPECIAL ONLY **\$3**

**27MHZ CB AERIAL**

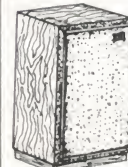
This HEAVY-DUTY, FULLY-ADJUSTABLE, HELICAL Aerial is the one the "Truckies" LOVE! Aussie-made for standard black HF bases. No post, rail freight only. WAS \$23.50, **\$16**

**CB, HAM RADIO ACCESSORIES**

**MIKE for CB**  
GENERAL PURPOSE REPLACEMENT **\$8.99**

**1KW TVI FILTER** SHINWA "BIG-GUN" DE-LUXE MODEL **\$17**

**COMMUNICATIONS POWER MICROPHONE**  
Leson high quality with compression, LOW NOISE **\$19**



**\$49** 15W 8 Inch 2 WAY PAIR **speaker systems**

**at bargain prices!**

Famous maker HI-FI SPEAKERS, slightly shop-soiled but otherwise A1, as used on \$400-\$500 hi-fi systems. We were selling these at \$79 PR, but now we need the warehouse space, so, out they go! Overall size 680x 295x230mm deep, weight 20 Kgs. Do not include P/P, send "FREIGHT TO PAY" by road.

**EX-COMPUTER GUARANTEED FANS**

115v 3" **\$15** 115v 5" **\$15** 240v 5" **\$18**  
82x82x40mm 130x130x30mm 130x130x40mm

**THIS MONTH ONLY 2 FOR \$15**

250v 6" **\$17** 220v 7" **\$19** 220v 7" **\$21**  
166mm diam. 185mm diam. 185mm diam.

**POWERFUL HIGH VELOCITY BLOWERS**  
SINGLE OR TWIN SQUIRREL-CAGE 240v BLOWERS **\$24** LARGE HEAVY-DUTY 240v FANS 200x200x100mm

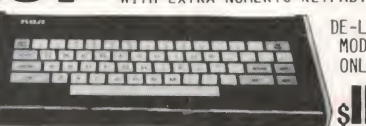
WE'RE OVERSTOCKED - PRICES DRASTICALLY REDUCED!

**WANTED To Buy?**

ALL TEST EQUIPMENT  
ELECTRONICS MAGAZINES  
SMALL OR LARGE STOCKS OF ELECTRONIC PARTS ETC.  
COMPUTER EQUIPMENT  
CB AND HAM RADIOS  
TRANSCIVERS  
VIDEO TAPE RECORDERS ETC

**NEW RCA KEYBOARDS**

**\$97** LATEST TOUCH TYPE KEYBOARD IS READY TO PLUG-IN AND USE. NOW AVAILABLE AS A DE-LUXE MODEL WITH EXTRA NUMERIC KEYPAD.



**12V DC to 240V AC POWER INVERTER**

RUNS FRIGDES, TV's, RADIOS LIGHTS, ALMOST ANYTHING! REGULATED OUTPUT, 240V ± 5% RMS 50Hz ± 0.5% INPUT 11-15V DC **\$209**  
NORMALLY \$249. SAVE \$40 With reversal switch, use as a battery charger, 7A output from 240V mains.

**MINI RELAYS**

EA. **\$1.49** 240V AC HEAVY DUTY 10A CONTACTS 4 CHANGEOVER

SPDT 8 to 15V DC, 225 OHMS, PCB MOUNTING  
DPDT 24V, 700 OHMS, 5A CONTACT  
Great value, worth over \$5 **\$2.50** huge purchase enables us to sell for less than HALF! Buy 10's, \$2.25

**Philips TRIPLERS**

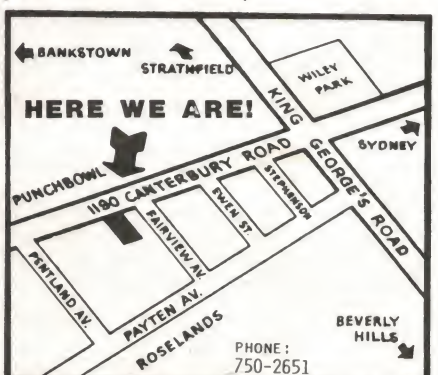
FOR COLOUR TV BEST QUALITY SIEMENS/VARO As used in Pyr, Philips, Kriesler and most German colour TV's. **\$9**

**EHT Trans**

Brand new Philips EHT Transformers. NOW REDUCED \$1.50 NT3100 NT3101 NT3122 **\$4**

**Telescopic AERIALS for TV's**

Both A pivot and swivel B As used by Philips A 170 to 875mm POPULAR TYPE **\$1.95** Pack of 10 **\$16** B 250 to 920mm HEAVY DUTY **\$2.75** Pack of 10 **\$22**



PHONE: 750-2651

**G.I.S. ELECTRONICS**  
SYDNEY'S NEW ELECTRONICS CENTRE

1190 CANTERBURY RD,  
**PUNCHBOWL 2196**  
NEAR ROSELANDS SHOPPING CENTRE

**TRADING HOURS**  
MON-FRI: 9:00AM-5:30PM  
SAT: 8:30AM-5:00PM

**Fast Mail Orders**  
PACK/POST: ADD 10% ORDER VALUE



~~\$159~~

IF YOU THINK WE PACK A LOT INTO OUR ADS,  
YOU SHOULD SEE WHAT'S IN OUR SHOPS!



# a NEW magazine

## PROFIT IMPROVEMENT THROUGH INVENTORY CONTROL

The potential for substantial profit improvement is vast enough to drive inventory control.

**GRAHAM J. HENRY**

## VDUS HOW SAFE ARE THEY?

It has been said about the health hazards of VDUs: The answer looks at what a company can do to safeguard the health of its staff.

**JOHN NICHOLLS**

## USING A COMPUTER TO IMPROVE YOUR BUSINESS

Businesses should keep under review the opportunities and the benefits offered by computers. What was not worthwhile two years ago may now be imperative to contain costs and stay competitive.

**PATRICIA BURN**  
*Independent Consultant*

# COMDEC

BUSINESS TECHNOLOGY FOR THE NON-TECHNICAL

## JUSTICE KIRBY

Exclusive Interview



**Special Purchasers' Edition**

Business Technology for Lawyers  
Instant Business Information

# for a NEW business age

Whatever business you're in you need to know how to get the best from the new technology, and **Comdec Business Technology Magazine** tells you what you need to know.

Each issue is jam-packed with authoritative articles on every aspect of computing and business technology — explaining precisely (and in plain English) how it will improve your practice, business or organization.

Comdec Business Technology Magazine, 4th Floor, 15 Boundary Street, Rushcutters Bay NSW 2011.



# COMPUTING TODAY

**Colour or color — who cares?**

**Tandy's new TRS-80 has it!**



Latest machine on the colour home computer bandwagon is Tandy's TRS-80C 'Color' computer designed to make "... computing fun for all the family".

**Featuring full colour graphics, programmable sound output, colour BASIC language, ROMpak software with games as well as applications and expandability from 4K to 32K, the TRS-80C is to be released here this month.**

It has enjoyed phenomenal sales since its release in the US (reportedly in excess of 70 000) and non-Tandy software support is huge. Even the Tandy range of software is very extensive, including everything from arcade games to financial programs and colour word processing. It plugs directly into any colour TV (channel 3 or 4).

Although designed to appeal as a games/home computer for com-

puter fun and frolics at low cost, taking Atari and Commodore head on, Tandy think the TRS-80C will appeal to the education market here also.

The 'basic' machine comes with 4K of RAM, eight-colour capability and a very comprehensive teach-yourself manual. All for just \$599, which pitches it fair and square between the Commodore VIC and the Atari 400.

Attachments include joysticks (for games playing) at \$39.95 the pair and a disk drive that plugs into the ROM cartridge port (takes up to four disk drives) for \$699 per drive.

The 16K version with extended colour BASIC costs \$849 while the 32K version is \$1099. The extended

colour BASIC features advanced graphic capability and easy programming with such commands as CIRCLE, LINE and PAINT.

Program ROMpaks available from Tandy cost either \$49.95 or \$59.95 and include such goodies as 'Project Nebula', a space game with superb graphics and simulated 3-D movement; 'Skiing', which simulates a downhill race against the clock where you are the skier and the screen shows the scene you would 'see' — very realistic; 'Dino Wars' where two players control a dinosaur each (Tyrannosaurus Rex, no less!) complete with sound effects (the monsters roar and go 'cark, cark' when they die!); plus a filing system, personal finance manager, etc.

For those with extended colour BASIC, Tandy offer a 'Color SCRIPSIT' word processor ROMpak with menu and labelled function

keys plus powerful editing features like string search and replace, block move or copy, variable line widths. It also has automatic word wraparound.

There's an RS-232 interface port and of course you can attach a printer.

We're right in the middle of an extended evaluation of a 16K machine and a host of software at the moment, so watch for a full review in an upcoming issue.

See your nearest Tandy dealer for more details or traipse along to a Tandy Computerrama show: Feb 7-8 at Lennons Plaza in Brisbane, Feb 28 — March 2 at Centrepoin in Sydney, March 7-9 at the Southern Cross in Melbourne, March 23 at the Parmelia Hilton in Perth and March 27 at Adelaide's Festival Centre. Take your Bankcard!





AND



## WE HAVE WAGED WAR AGAINST WITH THREE NEW OP-

**I/OS SINGLE USER**

**MULTI/OS**

### ALL THREE SYSTEMS ARE TOTALLY COMPATIBLE

INFOSOFT COMPRISES SOME OF THE MOST RESPECTED PRO-  
CROMEMCO **CDOS/ SD SYSTEMS SDOS&COSMOS/**

Due to the respect we gained with Infsoft through our SUPERAED and  
been appointed sole Australian, New Zealand, and New Guinea representatives  
other Infsoft products.

	<b>I/OS-MULTI/OS</b>	<b>CP/M-MP/M</b>
SOFTWARE SUPPORT OR HARDWARE:	Large device and Disk Driver Library	Nil from Digital Research
EASE OF IMPLEMENTATION:	Easy due to Driver Type structure and dialogue menu configuration	Difficult due to BIOS struc- ture and limitations
MIN SIZE FILE ON HARD DISK:	1K	16K
MAX LOGICAL UNIT SIZE:	65' MEG	8 MEG
MAX STORAGE CAPACITY:	975 MEG	128 MEG
MAX NO. OF FILES:	63,000+	1024
MAX NO. OF DIRECTORIES PER UNIT:	252	1
SUB DIRECTORIES:	YES	NO
DISK MANAGEMENT:	On Disk, shelf checking	In memory, easy to Glitch
MULTIUSER/SINGLE USER COMPATIBILITY:	TOTAL	POOR



# JOIN FORCES

**INCOMPATIBILITY AND WON!**

**ERATING SYSTEMS:-**

**MULTI TASKING  
MULTI USER**

**MULTI/NET NETWORKING  
SYSTEM**

**WITH CP/M & CDOS AS WELL AS MANY OTHERS!**

GRAMMERS IN THE U.S.A. AND ARE THE ORIGINAL WRITERS OF  
MOSTEK/OS/80 DIGITAL CORP'S TDOS

SUPERCOMPUTER project (as reviewed in Sept/Oct Your Computer) AED has  
and distributors for these magnificent operating systems as well as all

## OEM'S AND DEALERS

AED HAS SPECIAL ARRANGEMENTS FOR  
YOU.

Make your products more attractive to your  
buyers through the extra power and  
compatibility of Infsoft's Better Way. IF YOU  
WISH TO IMPLEMENT MULTI USER THEN  
WE HAVE THE EXTRA HARDWARE OR THE  
INFO TO HELP YOU!

THESE SYSTEMS ARE VERY EASY TO  
IMPLEMENT COMPARED TO CP/M AND  
ESPECIALLY MP/M.

WE ARE LOOKING FOR AGENTS FOR NEW  
ZEALAND, NEW GUINEA, MELBOURNE,  
PERTH, BRISBANE AND COUNTRY  
REGIONS.

IF YOU THINK YOU CAN KEEP UP WITH  
THE PACE, RING US NOW.

## SPECIAL OFFER

If you are a legitimate owner of CP/M or CDOS we  
will sell you a copy of INFOSOFT I/OS for \$120 —  
which is about half the normal price!

## EXTRA SPECIAL OFFER

IF YOU PURCHASE OUR AED SUPERCOMPUTER  
WITH MULTI/OS, WE WILL PROVIDE FREE  
UPDATE TO OUR 16 BIT MULTI USER OPERA-  
TING SYSTEM WHICH IS BEING WRITTEN FOR  
US BY INFOSOFT.

NOTE: THE NOW FAMOUS SUPERAED FEATURE  
OF OUR SUPERCOMPUTER IS FULLY SUP-  
PORTED ON THE NEW SYSTEMS.

— THAT'S COMPATIBILITY PLUS FROM AED —

TO CASH IN ON THESE OFFERS  
CONTACT US NOW AS THEY MAY HAVE  
TO BE LIMITED.



(02) 681 4966 Open 9-6 MON-SAT

**MICROCOMPUTER PRODUCTS**

130 MILITARY RD., GUILDFORD N.S.W., 2161 TELEX AA70664



# Print-out

## For Sorcerer Apprentices

**A short one this month; I'm off to a well-earned rest in the mulga, away from all technicalities and computers. If I survive it without any major side effects, I shall dig into the real stuff in the next issue again.**

Speaking of technology, I'm ever grateful for all the fantastic inventions today's society cooks up for us. While television has taught me to eat on my lap in the lounge room rather than the dining room (the dining room is now the computer room!), my eternal thanks really go to the developers of home computers.

My computer has given me countless hours of joy and/or frustrations, but it has also aroused some deep-seated primeval properties I never even dreamed I possessed. I have learned to eat junk food on my lap, keeping two fingers totally free of grease, tomato sauce or whatever else might be dribbling off. I know exactly how many cups I can wash between compilations. I learned to converse on absolutely unrelated matters while keying in programs or whatever with a minimum of errors in both areas. I can blame the computer for the moods I'm in, be they good ones (the program finally worked), or bad ones (someone gave me another one of those programs!). I made lots of friends with a minimum of effort; we have a common interest known to us on the first meeting. If we run out of conversation we can always go back to talking computers. And, as a passive, not so innocent bystander, I can blame the computer for any hassles I may have with personal relations. All in all, I would not be without it. Computers make the ideal Christmas gift. The unfortunate part is that computer stores do not appear to have after-Christmas specials.

And now to a completely unrelated subject: piracy of programs has been a problem in the industry from the very start. While some people spend hour after hour writing programs and hope to get some remuneration for their troubles, there are others who spend hour after hour copying these programs, but not without first removing the copyright notice and author's name and inserting their own primitive little slogans. This of course is illegal. I do not pretend for one moment that every program in my possession has been legally obtained, nor do I pretend to understand the copyright laws, which are currently under review and will be upgraded in the near future. Reports on the subject I've heard and read seem to suggest that the proposed changes will be just as incomprehensible as the current ones are, the act appearing to concentrate on the music industry and on photocopying. Since there is no self-regulating body within the industry and no one can guarantee that individuals are never going to pirate programs, authors have been locking their programs.

Locked programs are a good indication of the quality of a program you buy. Obviously, the author must have an above-average understanding of the Sorcerer to be able to achieve the locking in the first place. A locked program simply means that you won't be able to re-record it. Thus the authors make sure that there are no errors in the programs, since you would not be able to fix them. There is no more damaging advertising than having faulty programs in circulation which cannot be repaired by the frustrated owners. I own about 30 programs, of which nine are locked programs. 21 of my 30 programs have some kind of an error somewhere. Give me locked programs any time!

"What about backup copies?", I hear you ask. Recording of locked programs is generally excellent for obvious reasons. Unless you are a complete moron and treat your tapes the way you should not, there is no need for backup copies. Also, you'll find that most suppliers will replace your copy for a reasonable fee. After all, if you buy a diamond you take care of it; when you lose it you'll have to pay for a replacement. I cannot agree with anyone complaining about locked tapes; to me they indicate quality.

Lately more and more programs use the ability to generate

sound effects on the Sorcerer. To date I'm aware of three different types of sound-generators: the System Software (AUS) Soundplug, the Arrington Software (US) D/A converter and Software Source's (AUS) Soundbox. Soundplug plugs into the parallel port, so does the D/A converter. Soundbox connects to the cassette motor control unit.

The most sophisticated sound generator is, without a doubt, Howard Arrington's A/D converter. You need an amplifier for this unit; the stereo at home will do fine. As with all Arrington Software, documentation and programming style are excellent. A screen editor allows easy entering of tunes straight from musical sheets. Four-part harmonies, different tempos, etc, are all easily handled by this sound system. The A/D converter is highly recommended for anyone with serious musical applications.

Soundplug's main feature is its ability to drive a speaker without the need for an amplifier. I am a bit concerned, though, about one statement in the leaflet supplied with Soundplug asking the user to turn the volume down if the screen happens to flicker at the time of sound generation. I do not have enough hardware knowledge to tell if it could possibly damage my Sorcerer if I ignore this warning, but the power supply for the speaker obviously is being drained from the Sorcerer.

Soundbox is the lowest priced and is intended for the hobbyist to insert his/her own sound to their own programs. The leaflet supplied in conjunction with the box does not contain a tune, but at least the machine language program is listed as Basic Data statements. Soundbox requires a nine volt battery and has its own internal speaker.

Well, my fishing rod is packed, the billy is in the boot and I'm off. See you later...

A.P.F. Fry

## First public videotext order goes to IBM

**West Germany has picked IBM above other tenders (including British Prestel) for its public videotext system. The official reason given was that Prestel was too expensive, but it is also rumoured that Prestel's hardware and computer language (the little-known BABBAGE), which are not widely used outside Britain, contributed to its not being chosen.**

Prestel had been on trial in West Germany in two centres since 1979, whereas IBM launched its first

videotext product (software for linking videotext terminals to IBM processors) only in August last year. This software forms the basis of the IBM system to be used in Germany, and will run on a mainframe computer and 70 minicomputers, allowing all owners of IBM computers to hook into the 'Bildschirmtext', as the videotext system will be called.

A telling point in IBM's favour in the STG£12 million tender may have been the fact that it already dominates the German computer market and has sold the Bundespost (Post Office) three mainframe computers.

Prestel is currently being used by five countries on a trial basis — Austria, Hong Kong, Italy, Holland and the USA. After a trial in Switzerland, Prestel was rejected in favour of a rival system from the German

will make their decisions by the end of 1983.

Despite the setback in West Germany, GEC (a member of the consortium involved in Prestel), believes it can still win contracts for Prestel overseas, claiming that Prestel is the most advanced videotext system and is still the only system actually in use in a public service network. A disadvantage overseas is of course that national telecommunications authorities will naturally favour home-based suppliers.

Telecommunications authorities are finding that videotext is not as attractive to home users as was first imagined. In Britain sales targets for Prestel TV sets have been adjusted downwards several times, and British Telecom have now decided to concentrate on business users, who are more likely to pay for and use this type of information system. There are at present only around



firm Standard Electric Lorenz. It is expected that most countries evaluating videotext systems worldwide 1800 home users of Prestel in Britain, compared with about 11 000 business users.

## Software survey

The National Chairman of the Australian Computer Society's Software Industry Committee, Mr. Karl Reed, said today that the Committee was conducting a repeat of its software industry survey early in 1982.

"This nationwide survey is being funded by the National Council of the ACS and will be the only authoritative source of data on this growing industry," Mr. Reed said.

The ACS is particularly concerned with obtaining detailed information about the activity of microprocessor software providers, since this is a growing segment of the general software industry. "Our 1978 survey showed that the software industry was a major, growing, high technology one, but we targetted primarily the suppliers of software and services to the traditional EDP industry. Our concern on this occa-

sion is to obtain an accurate picture of the microprocessor segment," Mr. Reed said. "Microprocessors will become an increasing part of the computer scene, and supplying appropriate software will become an important industry. As a result the ACS survey must catch as many suppliers of microprocessor software as possible."

When asked, Mr. Reed said that the results of the ACS survey would be used in submissions to State and Federal Government on the industry and its needs. The results should also play an important part in bringing about an awareness of the

impact of technology on the Australian economy.

"The computer-related electronics industry is booming in this country, and may be as large as the minerals boom," Mr. Reed said. "Surveys such as this are the only means by which the size of this industry can be reliably estimated. Politicians are usually amazed to find that the survey will go to more than 800 companies."

Companies marketing microprocessor software, services and packages should write to the ACS-SIC team, c/o Louise Cheung, Dept. of Computing, RMIT, P.O. Box 2476V, Melbourne 3001. Telephone enquiries should also go to Miss Cheung on (03)341-2348.

Mr. Reed said that both the Department of Overseas Trade and the Department of Industry and Commerce were already taking interest.

## Interfacing the PC1211 to another computer

In the article reviewing the Sharp CE-122 dot impact printer in the November '81 issue of ETI ('You'll have a Shandy, then...?') we mentioned the possibility of interfacing the Sharp PC1211 computer (alias the Tandy pocket TRS80) to another microcomputer system, to allow the PC1211 to make use of a printer attached to the other system. Reader Andrew Wood of Sydney wrote to tell us that he had managed to do this, and is able to use a printer connected to a 6809-based system. Here's how he did it:

"The hardware required is mini-buffer the output from the PC1211, mal. I used a CD4049 CMOS IC to and connected it to a PIA on the

## THE SUPER EASY WAY TO DO YOUR TIMING DIAGRAMS



### LOGIC SCALE

Do your waveform/timing diagrams fast and professionally with a LOGIC SCALE from ALFATRON. Just move the sliders to represent your waveforms, lay it on a photo copier and fill in the details underneath. Made from solid ABS plastic that lasts for years.

A GREAT TIME SAVER AT A (BUDGET PRICE OF ONLY) A MUST FOR ALL ENGINEERING STUDENTS. **\$24.99**

### ALFATRON PTY. LTD

1761 FERNTREE GULLY RD  
FERNTREE GULLY VIC 3156  
PHONE: 758 9551

### NEW ADDRESS VIDEO

Mail to: Mail Order Dept.  
P.O. Box 254 Heidelberg Vic. 3084  
Phone: (03)435-3004  
1pm and 6pm Mon. to Sat.

#### OHIO SCIENTIFIC COMPUTERS (CIP)

HARDWARE: EPROMs to replace Monitor ROMs

EP.2. Dabug III Series 1	\$25
Dabug III Series 1-48 CHR Mod.	\$25
Dabug III Series 2	\$25
EP. 7. CIS (Aardvark)	\$25
EP.8. CIE (Edit & Window)	\$30

Still on Original Board:

EP.4. Fix ROM (for BASIC 3 chip)	\$24.95
EP.5. EPROM Set (20K ROM)	\$75

EPROMs for Mother Board:

EP. 1. Pascal (2 IC's)	NOW AVAILABLE \$39
EP.3. Extended Monitor	\$24.95
EP.6. Full Assembler (3 IC's)	\$55

#### RECENT SOFTWARE Titles:

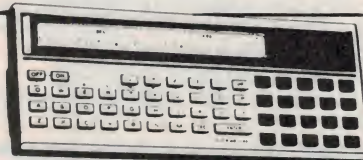
G.51 Rocket Jockey	\$9.95
G.53 Motor Cross	\$7.95
U.40. Organ 8K	\$9.95
U.41. Basic Line Remover	\$7.95
E.16. Slimming	\$9.95
E.17. Hangman (Spelling)	\$9.95
E.18. Life Expectancy	\$9.95
K.1. Hardware Catalogue	\$1.00 incl. P&P
K.2. The First 100 Items of Software	\$1.95

PLUS Pack & Post.

Add Pack & Post. All prices INCLUDE Sales Tax.  
Prices subject to change without notice.

### INTELLIVISION

SWAPCLUB MEMBERSHIP \$20.00  
EXCHANGE CARTRIDGE  
IF 100% CONDITION \$20.00  
FREE P&P. NO DRAUGHTS.



At last from ARC Soft Publishers  
easy-to-follow programs for your  
Tandy or Sharp Pocket Computer

### Murder In The Mansion

And Other Computer Adventures in Pocket-BASIC for the TRS-80

10 brand-new exciting tested ready-to-run game programs for your pocket computer - 64 pages \$9.95



### 50 Programs in BASIC for the Home, School and Office

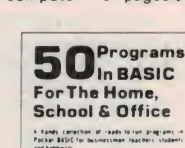
Tested ready-to-run programs for the businessman, student, teacher and for the home  
96 pages \$9.95

Also available  
50 MORE programs in BASIC for the Home, School and Office \$9.95

Pocket Computer Programming Made Easy \$9.95

### 50 Programs In BASIC For The Home, School & Office

A handy collection of ready-to-run programs in Pocket-BASIC for businessmen, teachers, students, and hobbyists.



### 101 Pocket Computer Programming Tips & Tricks

\$9.95

Pocket-BASIC Coding Forms and Universal-BASIC Coding Forms \$3.50ea.

Send cheque or money order plus \$1.00 postage to  
Sole Australian distributors: Powerchip Software,  
PO Box 32 Sth Caulfield Vic 3162. Phone 529 2884



# At last - the no comp

With the release of the MicroBee, Applied Technology brings you a state of the art computer you can build yourself. MicroBee is unique among kit computers in its price range. It offers facilities which make it comparable to machines costing 2 to 4 times its price. Brilliant, cost effective design and new technology have come together to make this machine possible. MicroBee is a complete computer. It is physically complete. You get a full case and chassis. You get the power supply. You get full manuals for assembly, BASIC programming and software development. IC sockets are supplied. The advanced 16K basic is supplied in ROM (not on cassette). There are no extras to buy with MicroBee. In terms of performance, MicroBee comes standard with features which come as extras on SYSTEM 80 and APPLE. Such as upper/lower case and RS232 interface. And things not available on either of these machines. Like continuous memory and built in sound. MicroBee achieves this at its incredibly low price by using the latest technology. The huge price drops in ICs in recent years have also aided us in bringing you the MicroBee at such a down to earth price.

## 16K ROM BASIC

MicroBee has been developed as the finest instructional computer on the market. Its superb 16K BASIC in ROM makes this possible. Whether you are a novice or advanced enthusiast, MicroWorld BASIC is a delight to use, with its advanced error reporting and powerful graphics facilities. Just to give you some idea of its power, its gives you:-

- Advanced error reporting with 33 comprehensive error messages and a feature packed program editor. This BASIC is so 'friendly' that anyone can master the computer and establish computer literacy, so vital in today's technological world.

```
06000 REM This subroutine draws a square of lengths l1,l2
06005 REM with the bottom corner at a1,b1
06010 VAR(A1,B1,L1,L2)
06020 REM Draw left side, then top, then right, then bottom
06030 GOSUB [ A1,B1,A1,B1+L2 ] 4000
06040 GOSUB [ A1,B1+L2,A1+L1,B1+L2 ] 4000
06050 GOSUB [ A1+L1,B1+L2,A1+L1,B1 ] 4000
06060 GOSUB [ A1+L1,B1,A1,B1 ] 4000
06999 RETURN
65000 END
```



- Powerful PLOT facility and high resolution graphics can be combined with alphanumerics to give the MicroBee unparalleled graphic display

Portions of lines may also be underlined for another effect,

e.g. This procedure must be followed at all times.

or in case of special notation ...

$$r = \frac{a \cos(w) + b \sin(w)}{c}$$

The verb in this sentence is is and

and educational capability. And with Microworld BASIC you have the support of a great software base. Your MicroBee will run the whole range of MicroWorld BASIC software. This includes a wide range of games and utilities. And the range is increasing all the time thanks to the enthusiasm of the Microworld Users Group.

Full constructional details as well as a BASIC manual and program development ideas are available this month as an article in

**your  
computer**

Due for Release mid February

## Complete Kit \$399

Includes manuals, case, 16K BASIC in ROM, power supply, and IC sockets. This kit is complete.

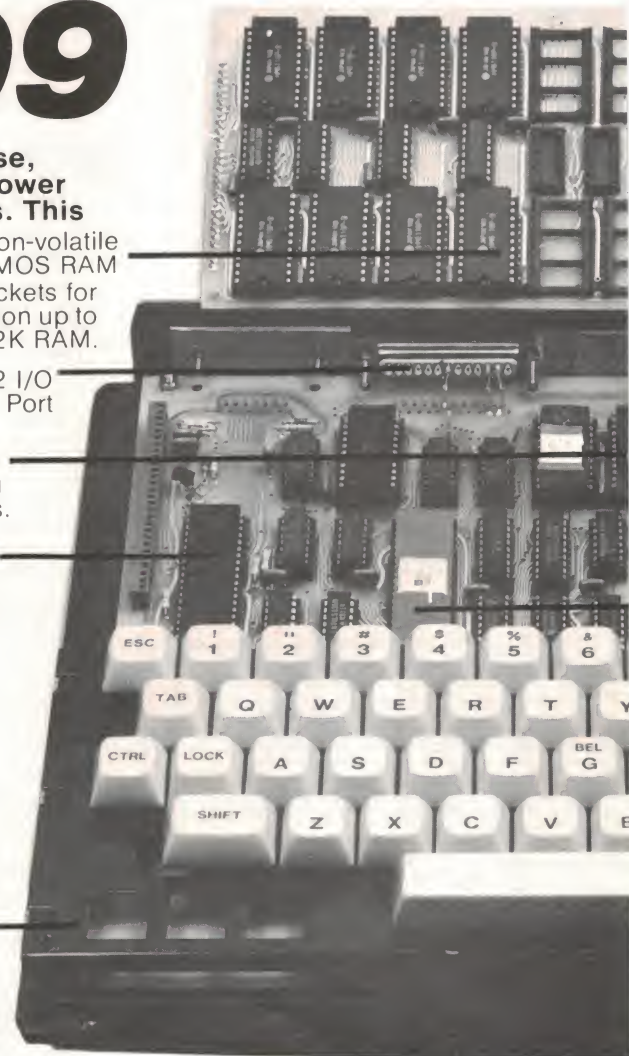
16K non-volatile CMOS RAM  
Sockets for Expansion up to 32K RAM.

RS232 I/O Port

PCG RAM and ROM gives you HiRes graphics.

Z80 PIO Programmable I/O Chip

Metal Baseplate Plastic cover is also supplied.





# promise kit computer

## MicroBee Brief Specs.

CPU	Z80A
VDU	Memory Mapped 16x64 format. Upper/lower case. Under BASIC. Hires 512x256 Low res 128x64.
Graphics	Full size 60 key QUERTY standard layout.
Keyboard	Interface loads and saves at 300, 1200 BAUD.
Cassette Interface	RS232. With connector.
Serial	Suits printers, modems etc.
Interface	Optional 8 bit I/O. Fully programmable.
Parallel	Internal speaker. BASIC control. 2 octaves, semitones. Period resolution 1/4 sec. Max. period 1/4x255sec.
Interface	12VAC at 1 amp (supplied).
Audio	
Output	
Power	



## How Good is MicroBee?

Compare MicroBee feature for feature with imported built-up Micros. Only then will you appreciate what a bargain it is. At last you can buy an Australian designed computer incorporating all the best features of TRS80, APPLE and SORCERER. But at a fraction of the price.



## NON VOLATILE CMOS MEMORY

The use of the latest CMOS RAM chips (6116), has made battery backup of memory possible. With MicroBee, you can store a program or data in RAM, switch off, come back later (or move the machine to a new location) switch on again, and your program or data is still there.

## No Apologies Service Coupon

With our easy step-by-step assembly manual, solder masked PC boards and socketing throughout, assembly is very straightforward. If you do have any trouble getting your MicroBee going, just fill in the NO APOLOGIES coupon supplied and return your kit to us for service.

## ORDER DIRECT SAVE TIME

To order your MicroBee, all you have to do is phone on our Hotline number, give your Bankcard number and name. We'll get the goods away to you right away.

**Hotline Number:-  
(02) 487 2711**

**Blue Ribbon  
Mail Order Service  
Mail Orders to  
PO Box 311, Hornsby  
2077.**



**APPLIED  
TECHNOLOGY  
PTY. LTD.**  
Showroom/Office at 1A Pattison  
Ave. Waitara.  
Hours: 9-5 Monday to Saturday  
Phone (02) 487 2711  
Telex APPTEC AA72767





other system. The main problem was the lack of information about the signals which are present on the 9-pin connector on the PC1211, and the format in which the data is transmitted.

"For those who would like to get such an interface working, the following information may be useful. This information is by no means complete, and cannot be guaranteed to be completely accurate.

"Numbering the pins on the PC1211 connector 1 to 9 from bottom to top (i.e. pin 9 is the one nearest to the LCD display): pin 1 is ground, pin 5 is Vcc (approx. +5 V), pin 9 is the serial data output line, pin 7 is the PRINTER/LCD DISPLAY select. If pin 7 is held high (Vcc) and the CA/BREAK key is pressed a few times, the PC1211 will subsequently send the output from LIST and PRINT commands out on pin 9 of the connector, instead of to the LCD display. Pin 8 may optionally be used to stop the PC1211 from transmitting, in the event that the printer cannot keep up. A high level on pin 8 will cause the PC1211 to pause.

"The data is transmitted asynchronously on pin 9, at a rate of about 500 bits per second (2 ms per bit), and is sent a nybble (four data bits) at a time, with the low order bit first after the start bit. It would seem that nybbles are always sent in pairs, to make up 8-bit bytes. The first byte transmitted is an indication of what is to follow:

80 — File name, from CSAVE command  
8D — Program line, from LIST command

8E — Print line, from PRINT command

8F — Data block, from PRINT # command.

(All values given are hexadecimal.)

"Data to be sent to the cassette interface, i.e. from the CSAVE or PRINT # commands, has a checksum byte every eight bytes, while data intended to be printed, i.e. from the LIST or PRINT commands, does not have this checksum.

"The code used is not ASCII, and unfortunately the encoded values of keywords are used; for example, the value D8 represents the keyword 'GOSUB'. Values 11 to 1D are special characters, as are the values 30 to 39. Values 40 to 49 are the numbers 0 to 9; 4A is the '.', and 4B is the exponent sign. 'A' to 'Z' are represented by values 51 to 69. The encoded keywords fall into the range 70 to DF, but many values in this range do not seem to be used. Values E1 to FA are used for 'reservable' keys. The end of a line is marked by a value of 00.

"Obviously the values associated with each character depend on which logic level you decide to call '0'. The above values are based on a low level on pin 9 representing a '1' — this at least gives a character set with numbers and letters in the usual order.

"If anybody is interested, I could provide them with further information, including a full translation table."

Thanks very much, Andrew, and if anyone is interested, Andrew can be contacted via P.O. Box C294, Clarence Street, Sydney NSW 2000.

## Acorns taking root

**The UK-designed Acorn microcomputer, which has achieved outstanding sales successes in the past year, is to be introduced to the Australian schools market, backed by a leading Melbourne-based building company, Glenville Homes Pty Ltd.**

The BBC in Britain recently placed an order for 22 000 Acorns for an on-air computer teach-in series, and the Acorn was also one of two machines selected to qualify for a 50% Government grant if installed in secondary schools in the UK.

A key factor in the choice of the Acorn system by the UK Government is believed to be its Econet, said to be the lowest-cost network in the world. This networking capability can be extended up to 255 units, although to date in Australia the largest network supports ten Acorn 'Atoms'.

The basic Acorn 'Proton' features 16K of main memory, a 32K ROM and a keyboard, all packaged in an integrated unit priced one-off at \$950. Floppy disk storage and a VDU are additional. The RAM is expandable on-board up to 32K, while the 32K ROM can be expanded to 48K. The Proton can support one or two floppy disks, an audio cassette recorder and a light pen input. As

well as provision for a professional video monitor, the Proton has an interface for a domestic black and white or colour TV receiver, an RS232 interface, a teletext adaptor, an analogue interface and an Econet interface.

Both PASCAL and BASIC languages are offered with the system, the BASIC being similar to the Microsoft standard but considerably extended.

Acorn Computers (Australia) Pty Ltd, a division of Consolidated Marketing Corporation (Imports) Pty Ltd, will market the Acorn micros, and will be specialising primarily in the emerging schools computer market.

The Sydney-headquartered company Liveware is at present writing a direct instruction package for the Proton.

For further information contact Mr. Julian Barson, Acorn Computers (Australia) Pty Ltd, (03) 419-3033. ▼

## DGZ80 sales top 1000

**The DGZ80 single-card computer, based on the S100 and Z80, has now exceeded sales of 1000 in Australia. Designed by local computer man David Griffiths, the DGZ80 is now in use in all major universities and many CAEs and schools.**

The DGZ80 is said to be so popular because it is just about the most powerful and flexible S100/Z80 card on the market. It has 2K of on-board RAM, Zilog PIO, switchable power-on-jump and optional interrupt control, and parallel and serial ports are all on-board. This makes it ideal as the basis of a very powerful personal computer system or as a stand-alone process controller.

The DGZ80 also has an optional monitor program, DGOS. Full source listings are available for

DGOS, and it is claimed to have become practically an industry standard. It incorporates very powerful block move, examine and replace routines, and has introduced hundreds of Australians to Z80 machine language programming.

Applied Technology, distributor of the DGZ80, felt that congratulations were in order on reaching the 1000 mark, and presented David Griffiths with a double-size DGZ80 card. He's said to be still looking for some double-size ICs to go with it!





**PRICE  
BREAKTHROUGH**

# A DAISY WHEEL PRINTER



**\$995**

MICRO-80 has converted the revolutionary new Olivetti Praxis 30 portable electronic DAISY WHEEL typewriter to operate as a correspondence quality printer. Now you can have the best of both worlds. The best auto-correcting portable electronic typewriter available AND a reliable word processing printer for your microcomputer.

Designed for private and light commercial use, the MICRO-80 conversion provides the PRAXIS with an industry standard Centronics printer port which will operate with most microcomputers including the TRS-80™, the SYSTEM 80™, the SORCERER and the APPLE. Average print speed is 120 words per minute. An RS232C serial to Centronics converter is also available from MICRO-80 to enable the PRAXIS or any other Centronics compatible printer to operate from an RS232C serial port.

MICRO-80 is an A Grade Olivetti distributor and has been producing printer conversions for Olivetti daisy wheel typewriters for 12 months. All typewriters sold by us carry our Australia-wide 90 day parts and labour warranty. If your need is for a larger, heavier duty typewriter/printer, contact us for details of the ET121 or ET221 conversions.

The demand for this great value printer is sure to be high. Use the coupon below to secure your order today.

**DEALER ENQUIRIES WELCOME**

TM: TRS-80 is a trademark of the Tandy Corporation  
SYSTEM-80 is a trademark of Dick Smith Electronics Pty. Ltd.

**MICRO-80** 433 MORPHETT STREET, ADELAIDE, S.A. 5000  
TELEPHONE: (08) 211 7244

Post now to:

**MICRO-80 PTY. LTD., P.O. BOX 213, GOODWOOD, S.A. 5034**

Please send me:

A PRAXIS 30 Typewriter converted to operate as a Centronics compatible printer \$995 ☐

An RS 232C to Centronics converter \$140 ☐

More details of the above products. ☐

I enclose my cheque/money order of \$.....

NOTE: Prices above are F.O.B. Adelaide

Please add \$10.00 for road freight anywhere in Australia

Please charge to my Bankcard

Bankcard No.

Expiry date:

Name:

Address:  Post Code:

TICK

☐

☐

☐





LET THE

# AUSTRALIAN SOURCE

BRING MAINFRAME POWER INTO YOUR HOME OR OFFICE



## WE ARE PROUD TO ANNOUNCE THE LAUNCHING OF AUSTRALIA'S FIRST MICROCOMPUTER INFORMATION UTILITY

*By Popular Demand Special Offer  
Extended until 28<sup>th</sup> February!*

The AUSTRALIAN SOURCE is Australia's first microcomputer information utility, aimed at giving the average microcomputer user access to the computer data banks and also massive storage space previously only available to large Mainframe installations. The era of home computers has now officially begun in Australia, now that the AUSTRALIAN SOURCE is here; as now, any small businessman or student can have on his desk for an extremely small cost, a system that has the level of storage power and access to data banks for which only a few years ago, government departments and large private users were paying millions of dollars.

The AUSTRALIAN SOURCE can be accessed through a number of 'approved' personal computers, and terminals, by use of an acoustic coupler or modem.

Users will receive a number of benefits which will include:

### INFORMATION SERVICES

Members will have access to a number of information sources which will include the latest news, sports results, financial reports, and farm information.

### NATIONWIDE ELECTRONIC MAIL

Members will be able, also, to communicate nationwide with other AUSTRALIAN SOURCE members through our electronic mail system.

THE AUSTRALIAN SOURCE  
RECOMMENDS 3M DISKETTES

### SOFTWARE BANK

Users will have access to a myriad of computer programs that will include entertainment, educational aids, programming and diagnostic tools, and financial applications.

### MAINFRAME POWER

Users will have the capability to make use of the Mainframe's huge storage capacity by using any of our large programs, or storing your large programs on our system.

### SHOP AT HOME

You can take advantage of our 'shopping by computer' system to get the best prices on a number of popular consumer items.

### EXTREMELY EASY TO USE

You do not have to be a computer programmer to make use of the AUSTRALIAN SOURCE. All of the instructions are in everyday English, so that even the younger members of your family will be able to operate the system.

### LOW COST

While services like these used to cost tens of thousands of dollars to the government departments and large corporations who used them, they are now available to you for less than the cost of a packet of cigarettes a day for the 'average' user.

You can join the AUSTRALIAN SOURCE by paying a one-time joining fee (normally \$100) and a small hourly user charge (normally \$10 an hour 8 a.m. - 6 p.m. and \$4.50 an hour 6 p.m. - 8 a.m.).

### SPECIAL CHARTER MEMBER OFFER

*As a special promotion, the joining fee before the 1st February, 1982, is only \$60 and this also entitles you to 20% off all list user charges in the future - a great deal for the money.*

TO JOIN THE AUSTRALIAN SOURCE FAMILY, AND TAKE ADVANTAGE OF THE EXCITING SERVICES WE WILL BE OFFERING, PLEASE COMPLETE THE COUPON BELOW:

#### MEMBERSHIP REQUEST

Yes, I think the idea of the AUSTRALIAN SOURCE is great! I enclose \$60, so please send me my user manual and password.

☐ I have a computer, Brand.....

Model.....

☐ Please send me information on low cost equipment packages I can use to take advantage of the AUSTRALIAN SOURCE'S services.

NAME: .....

ADDRESS: .....

CITY: .....

STATE: ..... POSTCODE: .....

PHONE: .....

Mail to

THE AUSTRALIAN SOURCE PTY. LTD.,  
364 LaTrobe Street,  
Melbourne, Victoria, 3000.  
Tel: (03)329.7998

☐ I am interested, but I need more information.

DEALER INQUIRIES INVITED





# “ICS helped take me from fish and chips to silicon chips.”

— A true ICS student story.

It's a long way from the counter of a take away food bar to an electronic technician's work bench. But that's what George Raftou achieved in under three years with ICS training. This is his story.

“I wanted a career, but I'd left school early, so I didn't have much hope. I couldn't afford to go on apprentices wages. And because of my education they wouldn't even have me at tech.”

That was three years ago, about the time George saw the International Correspondence Schools coupon in a magazine.

“I don't know why I picked electronics. I just figured with all the stereos and TV's around there seemed to be a lot of opportunities.”

## Study on full wages.

“The best thing about ICS was that I could study when it suited me and earn good money at the same time.”

ICS guided study helped George progress quickly. Systemised lessons, study notes and the guidance of a tutor make ICS programs one of the most personalised methods of learning. You learn at your own pace, taking time over difficult areas, rushing through subjects known to you.

After just one year, George passed his first PMG exam. This enabled him to join an electronics school that normally wouldn't take anyone who had left school so early.

“I joined halfway through the year, but was right up with the class,” George told us.

Today, George Raftou works with a leading electronics company servicing

calculators. He hopes the next promotion will see him in the company's computer division. All that achieved in less than three years.

## Turn your hobby into a career.

Like George Raftou you can use ICS training to enter the world's fastest growing industry.

Check the ICS electronics courses listed below then nominate a specific course in the coupon. We'll send you information without cost or obligation.

1. Basic Electronics.
2. Electronics Technician. Approved by TETIA.
3. Electronic Instrumentation and Control Systems.

4. Electronic Technology.
5. Electronics Maintenance.
6. Radio-Electronic Telemetry: electrical and electronic aspects of telemetering.
7. Amateur Radio Operator's Certificate of Proficiency.
8. Digital Electronics.
9. Data Processing.
10. TV Servicing. Approved by TETIA.
11. TV Principles.
12. Electrical Engineering Technician.
13. Electrical and Electronic Drafting.
14. Automobile Electrician.
15. Industrial Electrician.
16. Electrical Mechanic.

International Correspondence Schools  
(A'sia) Pty Ltd. 400 Pacific Highway,  
Crows Nest, N.S.W. 2065  
Tel: (02) 43 2121.

I am interested in the following course/s (please specify.)

Mr/Mrs/Miss.....

Please Print

Address.....

Postcode.....

Occupation.....

Age.....

Phone.....

Tick here if currently full time student. ☐

Write to your nearest ICS city: International Correspondence Schools.

Sydney: 400 Pacific Highway, Crows Nest, N.S.W. 2065 Tel: (02) 43 2121.  
Melbourne: 18-20 Collins Street, Melbourne, VIC. 300 Tel: (03) 656 1950.  
Brisbane: 131 Elizabeth Street, Brisbane. QLD. 4000 Tel: (07) 221 0178.  
Adelaide: 28 Grenfell Street, Adelaide. S.A. 5000 Tel: (08) 219 4154.  
Perth: P.O. Box D157, Perth. W.A. 6001 Tel: (09) 321 8530.  
New Zealand: 45 Courtenay Place, Wellington 1. N.Z.

0206



Bankcard

**ICS**

ICS 074 M&W



## Mincom buys electrostatic plotter

Mincom, a Queensland-based specialist mining computing company, has installed a Benson Quadramet high-resolution electrostatic plotter in its Sydney branch office, in order to expand and upgrade its services to meet clients' increasing needs.

The Quadramet was released to the Australian market in 1981 by the TCG Group, and is claimed to offer the highest resolution of any electrostatic plotter at 100 dots per centimetre (254 dots/inch), providing line quality comparable with conventional ink plotters. It offers exceptionally high resolution and density output, achieved by four off-set rows of writing styli compared with the conventional two on other plotters.

Printing specifications include Gothic font with 123 ASCII character set, and a character generator provides characters of two sizes. The Quadramet will print 470 lines per minute or 235 lines per minute, depending on character size. Plot speeds, depending on the model, range from 0.35 to 4 inches per second.

Mr. David Merson, Managing Director of Mincom, said, "The advantages of computer-based data management, deposit modelling and mine design are becoming

rapidly recognised at technical and management levels. Major companies are increasingly turning to computer techniques for geological data management and mine modelling, to enable the rapid generation of the data for financial evaluation.

"We are essentially a service company and as such must maintain facilities to provide substantial output as rapidly as possible to meet clients' needs. With the electrostatic we are now achieving in minutes the work it would take a draftsman a week to complete or a pen plotter at least an hour."

Mincom's computer operation is based on two Prime 750 Series processors, and a Benson model 5342 round-bed plotter installed at the Brisbane operation, and a Prime 750 processor and the new Benson electrostatic in Sydney.

For more information on the Quadramet contact Mike Barracough (02)439-6477, or Deirdre Davis (02)438-3466.



promotional work.

However, most people would probably meet the Tasman Turtle first in the entertainment area, where its design features are said to allow customisation and versatile implementation to a multitude of uses.

Tasman Turtles have the following features:

- heavy-duty stepper motor allowing for ramp or load manipulation for accurate positioning
- four channels dedicated to: horn on/off; horn tone; lights on/off; pen solenoid on/off
- four sensors for peripheral tactile interaction
- auxiliary input for custom use
- 25-pin RS232-type plug for connection to controlling device.

They require 8-bit parallel bidirectional data to access these functions, and a 2 amp 12 Vdc power supply.

Tasman Turtles cost \$799 including power supply, not including tax. You can get further information from Flexible Systems, 219 Liverpool St, Hobart Tas. 7000.



## Robots for sale

The Tasman Turtle is a sophisticated robot designed for use by anyone with a microcomputer or other microprocessor-based device such as an evaluation kit.

It is said to be capable of being used for serious work in laboratories or schools for computer studies, artificial intelligence, maze solving, robotics, logic, environment mapping, etc, and could also be used in commercial and business applications such as window display and

**archive**

COMPUTER SERVICES  
PO Box 13,  
23 Wagner Road,  
Clayfield, QLD 4011  
telex: 44187 ARCHIV  
telephone: (07) 262 2911

Note our new telex number 44187 ARCHIV

**OVER**

TAX FREE  
**\$4425**

WE CAN SUPPLY A WIDE RANGE OF COMPATIBLE TERMINALS, PRINTERS AND SOFTWARE

SINGLE METAL DESK-TOP ENCLOSURE - "OFFICE CREAM" & BLACK, CP/M 2.2 OPERATING SYSTEM, 4 SPARE 5100 EXPANSION SLOTS, 9600 OR 19200 BAUD TERMINAL PORT, SERIAL INTERFACE PORT FOR COMMUNICATIONS OR PRINTER, CENTRONICS PARALLEL PORT, 64K SYSTEM RAM, 2 ADDITIONAL PARALLEL PORTS, 4MHz Z80 PROCESSOR, 2.4MB DUAL DRIVE DOUBLE SIDED FLOPPIES REMOTE DIAGNOSTIC CAPABILITY

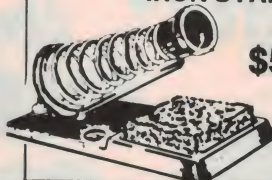


# RIT ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE, 3070

New

LOOK AT THIS!  
HEAVY BASE  
SOLDERING  
IRON STANDS



\$5.90

CLAMP METER



Model YF-700. Top of the range.  
AC voltage 150V, 300V, 600V.  
AC current 6A, 15A, 60A, 150A  
300A. Resistance 5K ohms  
(Midscale 200 ohms).

\$43<sup>55</sup>

normally \$49.99

## HEATSINKS

### High Thermal Capacity Black Anodised

	1-4	5-9	10-49	50-99	100-499	500 plus
HS1 - 38mm	1.85	1.75	1.50	1.35	1.00	0.90
HS2 - 75mm	3.00	2.90	2.50	2.00	1.50	1.40
HS3 - 150mm	5.80	5.40	4.90	3.80	2.90	2.70
HS4 - 225mm	8.10	7.60	7.10	5.90	4.50	4.30
HS5 - 300mm	8.90	8.40	7.90	6.50	4.90	4.60
<b>Unanodised</b>						
HS11 - 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 - 75mm	2.30	2.20	1.90	1.60	1.25	1.20
HS13 - 150mm	4.90	4.50	4.00	3.20	2.45	2.40

## COMPONENT SPECIALS

BF469 - \$ .90	BD 139 - .45c
BF470 - \$ .90	10 FOR \$4.00
2114 - \$1.95	BD 140 - .45c
4116 - \$1.95	10 FOR \$4.00
2708 - \$4.50	4MP2 XTAL \$2.00
2716 - \$5.50	
2732 - \$9.50	
TIP50 - \$1.10	

BATTERY SNAPS A STEAL AT 10c EACH  
3AG FUSE HOLDER 50c  
2AG FUSE HOLDER 50c

	1-9	10-99	100-999	1000
IN4148	.06c	.05c	.04c	.03c
IN4001	.06c	.05c	.05c	.05c
IN4002	.06c	.05c	.05c	.05c
IN4003	.06c	.05c	.05c	.05c
IN4004	.07c	.06c	.05c	.04c
IN4005	.09c	.08c	.07c	.06c
IN4006	.10c	.09c	.08c	.06c
IN4007	.12c	.09c	.08c	.07c
25K 134 -	\$6.20			
25J 49 -	\$6.20			
2.2 MF POLY				
400V CAPS	-	.90c		
555	-	.25c		
	10 FOR \$	2.20		
74C926		\$ 5.00		
BC547	100 FOR	\$ 9.00		
BC558	100 FOR	\$10.00		
BC559	100 FOR	\$10.00		
BC548	100 FOR	\$ 9.00		



## CANON PLUGS

	1-9	10 up
XLR-3-11c	\$2.90	\$2.80
XLR-3-12c	\$1.90	\$1.70
XLR-3-31	\$3.50	\$3.30
XLR-3-32	\$1.50	\$1.40
XLR-LNE-31	\$2.50	\$2.30
XLR-LNE-32	\$3.90	\$3.75

## REGULATORS

	1-9	10 up
7805	80c	70c
7812	80c	80
7815	80c	70c
7818	80c	70c
7824	\$1.00	90c
7905	\$1.20	\$1.10
7912	\$1.20	\$1.10
7915	\$1.20	\$1.10
7924	\$1.20	\$1.10

## RELAYS



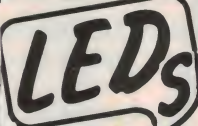
6 AMP CONTACTS PCB MOUNTING	
12V SP	\$4.50
12V DP	\$5.50
24V SP	\$4.90
24V DP	\$5.90

## PANEL METERS



MU 65 - DC 30V	\$10.00
MU 65 - DC 20V	\$10.00
MU 65 - DC 10A	\$10.00
MU 65 - DC 1A	\$10.00
MU 65 - DC 1mA	\$10.00
MU 65 - DC 100 UA	\$10.50
MU 45 - DC 300 V	\$7.50
MU 45 - DC 30 V	\$7.00
MU 45 - DC 20 V	\$7.00
MS 45 - DC 15 V	\$7.00
MU 45 - DC 10 A	\$7.00
MU 45 - DC 5 A	\$7.00
MU 45 - DC 1 A	\$7.00
MU 45 - DC ± 50 UA	\$7.00
MU 45 - DC 1 MA	\$7.00
MU 45 - DC ± 100 UA	\$7.50
MU 45 - DC 50 UA	\$7.00
MU 45 - VU	\$7.00
MU 65 - E VU	\$12.00

Extra Large



	3mm	Red	15c	10 up	13c
Green	20c		15c		
Yellow	25c		20c		
5mm	Red	10c		8c	
Green	25c		20c		
Yellow	30c		25c		
Orange	30c		25c		
RECT Red	.25c		.20c		
Green	.30c		.25c		

## SPECIAL



YF303  
MULTIMETER  
AC/DC volts up to 1200V DC  
current 3mA to 12 A An easily  
read OHMS range transistor  
checker etc

\$22<sup>50</sup>

YF370  
MULTIMETER  
Our most popular tester  
includes transistor checker

\$19<sup>50</sup>

COMPUTER  
COOLING  
FANS



Special  
4" \$19.50

## SPECIAL

ULTRA-SONIC  
TRANSDUCERS

\$11.00 a pair  
40Hz Tx & Rx.



## WELLER SOLDERING IRON

A transformer powered soldering station, complete with a low voltage temperature controlled soldering pencil. The special Weller "closed loop" method of controlling maximum tip temperature is employed thereby protecting temperature sensitive components while the grounded tip protects voltage and current sensitive components. The soldering pencil features stainless steel heater construction, a non-burning silicon rubber cord and a large selection of iron plated tips in sizes from 8mm to 6mm diameter with a choice of tip temperature of 600 degrees F/315 degrees C and 800 degrees F/430 degrees C.



\$58.50

## SCOTCHCAL RANGE

8016	Blue on White Plastic	\$5.50
8018	Green on White Plastic	\$5.50
8011	Red on White Plastic	\$5.50
8012	Black on transparent Plastic	\$5.50
8013	Black on Yellow Plastic	\$5.50
8015	Black on White Plastic	\$5.50
8009	Light blue on aluminium	\$5.50
8001	Red on aluminium	\$5.50
8005	Black on aluminium	\$5.50
8007	Reversing film	\$4.90
NOTE: ALL ABOVE SHEETS 10 x 12		
8500	Photosensitive Developer	\$9.40
3900	Clear Coating (Glossy Finish)	\$9.30
3930	Clear Coating (Matte Finish)	\$9.30
ML-3	Applicator block	\$3.90
ML-4	Developer pads	\$8.90 (per 100)
8002KA	Evaluation Kit	

## TWIN CONE SPEAKERS

10 watt  
speakers with  
great response.

\$7.50 each



## HORN SPEAKERS

Ideal for  
alarm

5 watt \$6.90  
15 watt \$17.50

SPECIAL



## SWITCHES

- C&K 7101, 1 to 9 90c; 10 up to 85c; SPDT.
- C&K 7201, 1 to 9 \$1.30; 10 up \$1.20; DPDT.
- El-Cheapo SPDT, 1 to 9 75c; 10 up 70c.
- El-Cheapo DPDT, 1 to 9 \$1.20; 10 up \$1.10.
- Single pole momentary push-button El-Cheapo, 1 to 9 25c; 10 to 25 23c; 25 up 22c.

## TOP QUALITY NI-CAD BATTERIES

D-Cell size \$6.90. C-Cell size \$6.25. P&P add 30c per cell. Also available in protected pack form for specific voltage and current applications. Prices and information on request.



## 19 INCH RACK MOUNTING BOXES

	1-5	5 up
Black	\$37.50	\$34.50
Standard	\$36.50	\$34.50

## TRANSFORMERS

2851 6.3-0-6.3 150mA	\$2.90.
2155 0-15V 1A	\$4.50.
6672 15-30V 1A	\$5.90.
R1810 8V at 10A 2x15V	\$26.50
R1820 8V at 20A 2x15V	\$35.50

## RECTANGULAR LEDs



Red,  
Green,  
Yellow,  
20c ea.

TO ORDER: Heavy items sent Comet freight-on. Mail Order phone 481-1436. Wholesale customers phone RITRONICS WHOLESALE 489-7099 or 489-1923. Mail orders to PO Box 235, Northcote 3070. Minimum mail order \$2. Add extra for heavy items, registration and certified mail. Prices & specs subject to change without notice.



*The affordable  
computer!*

*the brilliant*  
**DICK SMITH  
SYSTEM 80**

**OVER 5000 ONLY  
SOLD \$750\***

Note: Price includes increased  
Government Sales Tax

**Outstanding value for money . . . plus  
programs especially written for Australia!**

**Australia's fastest selling  
computer — and small wonder!**

**Compare the System 80 with its  
competitors: you'll see why!**

**And now it's even better: with  
new features to make your  
computing even better.**

**Join the thousands of System 80  
users now: turn yourself into  
a computer expert!**

**REMEMBER: OUR COMPUTER COMES WITH  
INBUILT CASSETTE & VIDEO MODULATOR**



**NEW**

ready to go  
**DISK DRIVES**

**&  
still  
cheaper  
per byte!**



Superb new model disk drives with  
power supply inbuilt! Ideal for all  
System 80 and TRS-80 computers

and many others . . . and they are still cheaper than  
Tandy drives. Two models — one configured for drive 0  
(Cat. X-4060), and the other configured for drive 1  
(Cat. X-4061). It couldn't be easier!

**ONLY  
INCLUDING  
POWER  
SUPPLY \$419**

**NEW**

**IMPROVED  
EXPANSION UNIT**

**EXTRA FEATURES**

**EXTRA  
MEMORY  
FITTED & YOU  
SAVE \$100!**



Previous  
Model \$499.00!

**NOW ONLY**

**\$399**

A brand new model — now  
with extra value! Comes with  
16K RAM plus provision for  
extra 16K (making 48K total  
including your computer) and  
it's \$100 cheaper than the  
previous model. (RS 232 inter-  
face and S-100 card optional  
at extra cost).  
Now you can have a full 48K  
computer for \$299 less!  
Cat. X-4020

**DICK SMITH  
ELECTRONICS**



**See our other ads for address details**





# No other printer has ever made such an impression!

No. 1 in the World\* . . . . . No. 1 in Australia\*

It's no idle boast when we say EPSON printers are outselling all other brands in Australia and throughout the world . . . . it's a proven fact! Why? Because EPSON printers are packed full of quality features that represent the best value for money on the market today!

**Features:**

- 3 way paper handling • Text and bit-image high resolution graphics printing • Variable printing widths and character sizes • Full 96 ASCII with descenders • Bidirectional print with logic seeking • 8 international character sets • Horizontal and vertical tabs • User replaceable print head • Versatile interface options • Correspondence quality printing. Also available MX-100 15" wide carriage printer.

*Have a look at the EPSON range today . . . . we know you'll be impressed!*

## THE EPSON MX-80 F/T TYPE 11

DEALER ENQUIRIES WELCOME

\*printers under \$1000

For further information

contact your local **WARBURTON FRANKI** office.

• ADELAIDE (08) 356-7333 • BRISBANE (07) 52-7255 • HOBART (002) 28-0321 • MELBOURNE (03) 699-4999  
• PERTH (09) 277-7000 • SYDNEY (02) 648-1711 • AUCKLAND N.Z. (09) 50-4458 • WELLINGTON N.Z. (04) 69-3016

## WARBURTON FRANKI

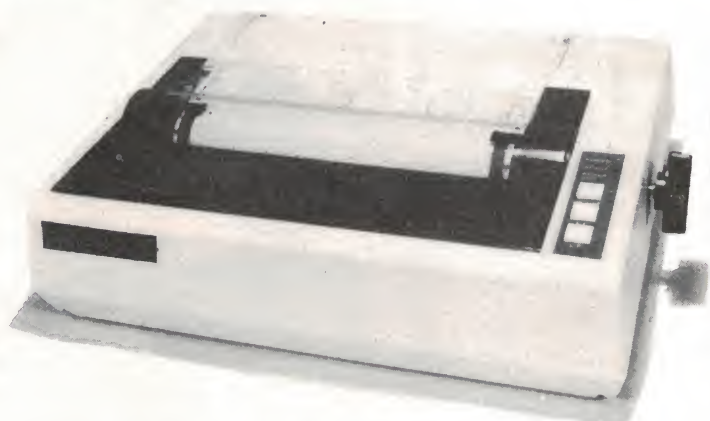




# Direct copy addition for the Sorcerer/MX80 printer combo

Don Thomasson

Here is a method of getting the Sorcerer to print what it's showing on the screen onto an attached Epson MX80 printer.



THE EPSON MX80 printer employs a pair of microprocessors to control its actions, an 8049 and an 8041. The program for the 8049 is quite large, extending to 6K, and the behaviour of the printer can be varied extensively by using different programs.

The original program provided a number of type styles, vertical and horizontal tabulation, variable line pitch, and a number of other facilities. A later version dropped some of these facilities, but added 'Bit Mode', of which more anon. The most recent version seen at the time of writing covers most of the features offered by either of its predecessors, plus italic type and reverse video types. Since none of these programs appear to have identifying references, it is necessary to be specific when enquiring about them.

It should be added that some of the programs are available in three-ROM form, and to use these it is necessary to cut a link on the main circuit board to disable the program held in the 8049 microprocessor. Others are supplied as a 4K ROM and a specially programmed 8049. A little confusing, till you get the main idea.

## Bit mode

The most interesting facility offered by these programs is 'Bit Mode', which allows every dot position in the whole printout area to be defined as black and white. The only snag is that this can involve quite a lot of dots, up to about 7400 per square inch. An A4 page could accommodate 650 000 dots, and storing that would involve more than 80K bytes of storage!

For some types of work, such as graph plotting, the amount of data can be cut down by specifying the position of black dots and counting off the white dots from the left hand margin, but even that can involve some complex programming.

For those who find themselves frustrated by their inability to make adequate use of Bit Mode, Screenprint may provide an answer.

## Screenprint

Screenprint is a machine code program for the Z80, and though described here for the Sorcerer it can be adapted quite easily for other computers with memory-mapped displays.

The Sorcerer stores its screen data in 1920 bytes of RAM, each byte relating to a given character position on the 30-line by 64-character screen. Each byte holds an ASCII code, which is translated into a pattern of 64 dots by reference to the standard character RAM or the graphics RAM. The latter can be set by software to any desired pattern, though the lower half of the graphics range is reset to standard forms when Clear Screen is called.

Screenprint begins by setting IX to F080, the start of screen RAM, this being the screen pointer. An output sequence 1B, 41, 08 is then sent to the printer, to set up a line spacing of 221.5 mm. Some, but not all, MX80 programs require this to be followed by the sequence 1B, 32 to confirm the setting.

Bit Mode with 512 characters per line is then set by the sequence 1B, 4C, 00, 02. This has to be done afresh for every line.

HL is now set to F800, the start of the character definition area, and the first character is read into A. The result is multiplied by eight and added to HL to form a pointer, each character definition occupying eight bytes.

The next operation involves storing the eight bytes defining the character, after which the first bit of each of the eight bytes is assembled in A to form the first data output to the printer. This process is necessary because the bytes define eight horizontal dots, whereas the

Epson's trusty little matrix printer contains enough processing power to be able to cope with various type styles, tabulations and line pitches. It also copes with dot resolution graphics, and some examples can be seen on the right.

printer requires eight vertical dots.

When A has been set, a NOP byte is provided; changing this to 2F reverses the print action to white on black, like the screen image, but black on white is clearer.

The byte is then output, and the program loops to J4 to assemble the next output byte. When eight bytes have been transferred, a jump is made to J2 to obtain the next character.

When the line is complete, IX AND 3F = 0, this being used to induce a jump back to J1 to start a fresh line, unless IX has reached F800, one location beyond the end of screen RAM.

Finally, a sequence 1B, 41, 9 is output to restore the line spacing to the normal 1/6 inch pitch. Here again, some programs may require the sequence 1B, 32 to confirm the new setting.

## Performance

The time taken to print a screen is about one minute, and the print quality produced is good. There is a slight discrepancy between the vertical width of a line and the nearest vertical spacing, but this is not too obvious.

An important consideration is that a manual call to Screenprint will show up on the screen and thus on the printed copy, so it is usually wise to arrange for an automatic call at an appropriate point in the program which creates the display. If this is not possible, then the intruding text can be covered by using cursor left to regain the start of the line, spacing forward to erase the text, and then pressing Return. The Monitor does not object, and ignores the redundant part of the input.



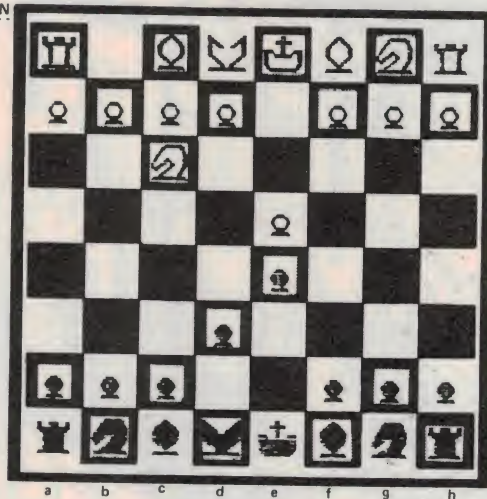
WHICH CLUB DO YOU CHOOSE? 19



HOLE1 DISTANCE 367 YARDS PAR4

PLAYER SARGON

0 E2-E4 e7-e5  
0 D2-D3 b8-c6  
03



Two sample printouts of graphics produced on the Sorcerer taken directly from the printer. Because some reduction of size has had to be performed in order to get them onto the page the individual dots have tended to close

up, but you can still see the difference in tones available. These are produced by putting less dots into a given area.

## Program Listing

```

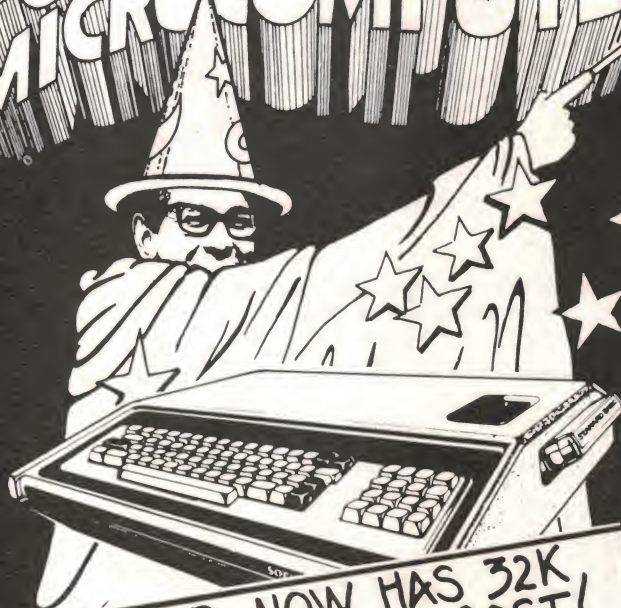
0008 C5      PARLOT EQU 0E021 ;PARLOT
0009 D5      SCRPR PUSH BC ;must be used
000A E5      PUSH DE ;because all
000B F5      PUSH HL ;eight bits
000C DD E5   PUSH AF ;must be
000E DD 21 80 FO LD IX,0F080 ;outputs
0012 3E 1B   LD A,27 ;ESC
0014 CD 21 E0 CALL PARLOT
0017 3E 41   LD A,65 ;A
0019 CD 21 E0 CALL PARLOT
001C 3E 08   LD A,8
001E CD 21 E0 CALL PARLOT
0021 3E 1B   LD A,27 ;ESC
0023 CD 21 E0 CALL PARLOT
0026 3E 32   LD A,50 ;2
0028 CD 21 E0 CALL PARLOT
002B 3E 1B   LD A,27 ;ESC
002D CD 21 E0 CALL PARLOT
0030 3E 4C   LD A,76 ;L
0032 CD 21 E0 CALL PARLOT
0035 AF      XOR A
0036 CD 21 E0 CALL PARLOT
0039 3E 02   LD A,2
003B CD 21 E0 CALL PARLOT
003E 21 00 F8 J2 LD HL,0F800
0041 DD 7E 00 LD A,(IX)
0044 DD 23   INC IX
0046 5F      LD E,A
0047 16 00   LD D,0
0049 CB 13   RL E
004B CB 12   RL D
004D CB 13   RL E
004F CB 12   RL D
0051 CB 13   RL E
0053 CB 12   RL D
0055 19      ADD HL,DE
0056 06 08   LD B,8
0058 11 00 00 LD DE,0
    
```

```

005B 7E      J3 LD A,(HL)
005C 12      LD (DE),A
005D 23      INC HL
005E 13      INC DE
005F 10 FA   DJNZ J3-$
0061 06 08   LD B,8
0063 21 00 00 J4 LD HL,0
0066 C5      PUSH BC
0067 06 08   LD B,8
0069 CB 16   J5 RL (HL)
006B 17      RL A
006C 23      INC HL
006D 10 FA   DJNZ J5-$
006F 00      NOP ;To allow for
0070 CD 21 E0 CALL PARLOT ;inversion
0073 C1      POP BC
0074 10 ED   DJNZ J4-$
0076 DD E5   PUSH IX
0078 E1      POP HL
0079 7D      LD A,L
007A E6 3F   AND 63
007C 20 C0   JR NZ,J2-$
007E 3E 0D   LD A,13 ;CR
0080 CD 21 E0 CALL PARLOT
0083 3E 0A   LD A,10 ;LF
0085 CD 21 E0 CALL PARLOT
0088 7C      LD A,H
0089 FE F8   CP 248
008B 20 9E   JR NZ,J1-$
008D 3E 1B   LD A,27
008F CD 21 E0 CALL PARLOT
0092 3E 41   LD A,65
0094 CD 21 E0 CALL PARLOT
0097 3E 09   LD A,9
0099 CD 21 E0 CALL PARLOT
009C 3E 1B   LD A,27
009E CD 21 E0 CALL PARLOT
00A1 3E 32   LD A,50
00A3 CD 21 E0 CALL PARLOT
00A6 DD E1   POP IX
00A8 F1      POP AF
00A9 E1      POP HL
00AA D1      POP DE
00AB C1      POP BC
00AC C9      RET
    
```



# THE MOST POWERFUL MICROCOMPUTER



**SORCERER NOW HAS 32K RAM AT NO EXTRA COST!**

**SAVE \$200!**

This month only

Yes! With every 16K

Sorcerer computer, we now include at no extra charge, an additional 16K of RAM! Here's your chance to buy the superb Sorcerer, and save money at the same time.

## Plus these other winning features:

- Built-in serial and parallel ports
- 2 cassette control ports
- Unbelievable graphics capabilities.
- Expandable to 48K on board.
- Uniquely versatile ROMPACS™ — instant change to dedicated processor, and back again!
- Built-in 4K ROM resident monitor.
- Economic disk storage now available (optional) with Exidy's new FDS — floppy disk subsystem (does not need expansion interface).

**All this for only \$1895**

including 32K memory and standard BASIC ROMPAC™

**\$1195**

Cat. X-3002

## ROMPACS™

*Give the Sorcerer its incredible versatility*

One moment it's a word processor. Then it's a production controller. Or a standard computer running a program. All you do is plug in the Rompac™. The Sorcerer does the rest!



### Word Processor Pac™

Not only more powerful than most other systems it's far cheaper! It features auto text wrap-around, auto checking of drastic commands, a search function, auto commands & macro programming etc etc. (X-3085).

**\$279**

### EPROM PAC™

Designed for users who want to use the Sorcerer for a dedicated job & can program their own EPROMs to do it. Up to 16K of ROM available. (X-3095).

**\$75**

### Development Pac™

A powerful dedicated development tool: contains a debug, text editor, linking loader, assembler & I/O routines. Complete with 90p manual. (X-3090).

**\$139<sup>50</sup>**

### Standard BASIC

(Supplied with Sorcerer computer in basic price - not available as a separate item).

## UTILITY SOFTWARE ON CASSETTE

### Z-80 DISASSEMBLER \$17<sup>95</sup>

This program 'disassembles' Z-80 machine language programs i.e. it translates them back into easier to follow assembly language. It is a BASIC program, but may be used to examine any machine language program in the Sorcerer's memory. X-3622.

### DEBUG \$17<sup>95</sup>

Designed to make it much easier to troubleshoot Sorcerer machine language programs. Lets you run programs one instruction at a time, examine contents of processor registers & insert breakpoints into the program wherever needed. X-3624.

### DUMB TERMINAL \$9<sup>95</sup>

Allows your Sorcerer to act as a 'dumb' communications terminal for X-3637 communication with a larger computer or with other terminals via the RS-232C serial port. Allows both duplex & half duplex operation.

## DISK UTILITIES FOR FDS & MICROPOLIS

### EXIDY CP/M \$6<sup>99</sup>

with EXBASIC X-3710  
Identical with Exidy CP/M, EX-BASIC is an extended disk version of Microsoft's BASIC 80. Complete with comprehensive documentation.

### DSKCTOH/P/PRINT \$12<sup>99</sup>

(Hard Sector). X-3725  
Disk driver & proportional printing driver for the Sorcerer Word Processor. Check these features: ability to save & load word processor files on disk, perform proportional spaced & bold faced printing.

### MICROSOFT EXT. \$3<sup>99</sup>

DISK BASIC FOR X-3712  
FDS. The most extensive version of BASIC available for Z-80 based computers. Features: full line editing, all normal disk facilities & commands, & much, more!

## SORCERER GAMES SOFTWARE ON CASSETTE

### Tank Trap



A enemy tank is on the rampage. Your job is to build a wall around it - without getting run over. Fascinating! X-3628 **\$14<sup>95</sup>**



### Martian Invaders

Very similar to 'Space Invaders'. A very challenging game, requiring skill & a fast mind. X-3626 **\$17<sup>95</sup>**

**New range of Sorcerer Software Arriving Soon**  
Ask at your nearest store!

### \* Wildemess \$6<sup>85</sup>

Here you trudge through the uncharted wilderness fighting foul monsters of many types. Great fun! X-3639

### \* The Count \$6<sup>85</sup>

One of the most challenging games ever written! You awaken in a bed in Transylvania. You don't know why you're there but you'd better solve the puzzle before it's too late! X-3638

### Magic Maze \$14<sup>95</sup>

Ten levels of play. You wander through a maze trying to stay on the right path and avoid pitfalls. Fantastic! X-3620

**\* LIMITED STOCKS**

# DICK SMITH Electronics



**NSW** 145 Parramatta Rd AUBURN 648 0558  
755 Terrace Level BANKSTOWN SQ 707 4888  
613 Princes Hwy BLAKEHURST 546 7744  
818 George St BROADWAY 211 3777  
531 Pittwater Rd BROOKVALE 93 0441  
147 Hume Hwy CHULLORA 642 8922  
162 Pacific Hwy GORE HILL 439 5311  
396 Lane Cove Rd NORTH RYDE 888 3200  
30 Grove St PARRAMATTA 683 1133  
125 York St SYDNEY 290 3377  
173 Maitland Rd TIGHE'S HILL 61 1896  
263 Keira St WOLLONGONG 28 3800

**Mail Order Centre:**  
PO Box 321, North Ryde 2113 Phone (02) 888 3200

**ACT** 96 Gladstone St Fyshwick 80 4944  
**QLD** 166 Logan Rd BURANDA 391 6233  
842 Gympie Rd CHERMSIDE 59 6255  
**SA** 60 Wright St ADELAIDE 212 1962  
Cnr Main St & Rdb Flagstaff Rd DARLINGTON 298 8977  
**VIC** 435 Main North Rd ENFIELD 260 4088  
399 Lansdale St MELBOURNE 87 9834  
260 Sydney Rd COBURG 383 4455  
295 Princes Hwy CORIO (GEELONG) 547 0522  
656 Bridge Rd RICHMOND 428 1614  
Cnr Dandenong & Springvale Rds SPRINGVALE 547 0522  
**WA** Cnr Wharf St & Albany Hwy CANNINGTON 451 8666  
414 William St PERTH 328 6944





**S-100 SPECIALISTS**

283 CLARENCE ST  
SYDNEY NSW 2000  
TEL: 29-2402  
922-1708

# ARE YOU STILL WAITING

FOR YOUR

MICROCOMPUTER ORDER?

While others are promising we are delivering EX STOCK. And we still have the best prices. Just take a look at these:

## RAM + 16

Features: S-100, 16K x 8 bit static RAM • 2 or 4 MHz • Uses 2114 1K x 4 static RAM chip • 4K step addressable • 1K increment memory protection, from bottom board address up or top down • Deactivates up to 6 1K board segments to create "holes" for other devices • DIP switch selectable wait states • Phantom line DIP switch • Eight bank select lines expandable to 1/2 million byte system • Data, address and control lines all input buffered • Ignores I/O commands at board address.

Bare Board	\$ 35.00
4Mhz kit	\$174.00
4Mhz A&T	\$199.00
Kit no RAM	\$120.00

## DYNAMIC RAM

T.J. 4116-3 16K for \$16.00  
Upgrade Super 80, TRS 80, and others  
Expandable + 64K.  
Dynamic RAM Board A&T.....\$425.00  
Guaranteed to work at 4Mhz or your money back

## QT SILENCE-MOTHERBOARDS

The Silence + has become one of the most tried and proven motherboards on the market. Using a unique grounding matrix, each line is completely surrounded with ground shielding which eliminates necessity for termination and gives the unit a very high cross talk rejection. One of the OEM customers has used the Silence + as high as 14Mhz without terminations.

### FEATURES:

- LED power indicator
  - Eliminates necessity for termination
  - Fits most industry standard mainframes
  - Available in 6, 8, 12 and 18 slot configurations
- |              |                    |          |
|--------------|--------------------|----------|
| QTCMB6BB     | 6 Slot Bare Board  | \$ 31.00 |
| QTCMB6A      | 6 Slot A&T         | \$ 81.00 |
| QTCMB8BB     | 8 Slot Bare Board  | \$ 33.00 |
| QTCMB8A      | 8 Slot A&T         | \$104.00 |
| QTCMB12BB    | 12 Slot Bare Board | \$ 39.00 |
| QTCMB12A     | 12 Slot A&B        | \$138.00 |
| QTCMB18BB    | 18 Slot Bare Board | \$ 61.00 |
| QTCMB18A     | 18 Slot A&T        | \$178.00 |
| S100 Sockets | Solder Tail (Gold) | \$ 6.30  |

## SYSTEM + II (2MB +)

Computer system with 8" Dual Sided Drives (uses Y-E DATA YD174 Disk Drives) Terminal not included.

A&T (6 Slot)	\$3883.00
A&T (8 slot)	\$4083.00

QT Systems are designed for both businessmen and engineers in accordance with the latest IEEE standards. Among other functions, they can be used for accounting and word processing as well as a variety of scientific applications. The systems are available with MP/M or QT DOS operating systems to allow multi-user, multi-tasking operations. QT also offers a full line of business and applications software, ranging from a business package to word processing.

Technical specifications: 4 Mhz Z-80 CPU • Dbl-sided, dbl-den 5 1/4" or 8" floppy disk controller (handles both drives simultaneously) • CP/M 2.2 included • 64K RAM, expandable per your requirements • Comes complete in single mainframe • RS232C serial port • Parallel port • Hard disk compatible • Monitor program & disk routines included on EPROM • Power-on/reset jump to monitor program • Documentation included • Extensive software available.

## SOFTWARE +

Word processing • System utilities and diagnostics • Games • CP/M users group diskettes \$10.00 each, catalogue \$6.00 • Pascal, Fort, Tarbell Basic, Fortran and most other compilers and utilities are available • Complete range of business software • Custom programming can be arranged on a fixed price or hourly basis.

## SBC2/4 Z80 S100 SINGLE BOARD COMPUTER

The QT Computer SBC2/4 Processor Board is a versatile and powerful Z80 based design which is compatible with the proposed IEEE S-100 bus standard. Although the SBC2/4 may be used as the host CPU of a large system, it has all the necessary features to be used as a stand-alone computer system.

Unlike old designs it will work reliably with dynamic RAM boards and more importantly with soft sector disk controllers, and hence standard versions of CP/M. This will give you access to the largest software base for microcomputers.

- Z80A 8 bit CPU
- 2 or 4 Mhz Switch selectable
- 1K RAM (which can be located at any 1K boundary)
- Full 64K use of RAM allowed in shadow mode
- DMA compatibility allows MWRT signal generation on CPU board or elsewhere in system under DMA logic or front panel control
- TWO programmable timers available for use by programs run with the SBC2/4 (timer output and controls available for use on CPU board).

Shipping weight: 2lbs.

QTCSSBC24B	Bare Board	\$ 66.00
QTCSSBC24K	Kit	\$199.00
QTCSSBC24A	Assembled and Tested	\$269.00

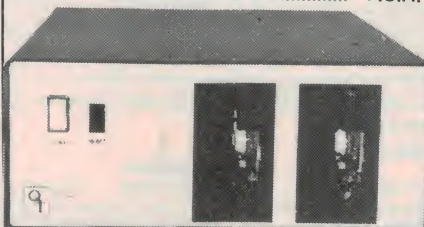
The MD+MD Mainframe offers the same quality as the MF+. It accepts two 5 1/4" disk drives with remaining space for either a 6, 8, or 12 slot Silence Plus Motherboard.

QTCMFMD	without Motherboard	\$400.00
QTCMFMD6	with 6 Slot Motherboard	\$480.00
QTCMFMD8	with 8 Slot Motherboard	\$500.00
QTCMFMD12	with 12 Slot Motherboard	\$540.00
QTCMFMDB	bare metal work	\$175.00

## DISK CONTROLLER

CCS2422A features ROM bootstrap loader and monitor • CP/M 2.2 with documentation included • Accepts 5 1/4" and 8" disk drives • Double sided/single sided select • Read, write IBM 3740 or system 34 single or double density • Fast seek available for voice coil operation • Automatic disk density determination • ROM bootstrap phantom.

CCS2422A A & T Incl. CP/M 2.2	\$399.95
JADE DD Bare Board	\$ 85.00
QTFDC II A&T Incl. QT DOS	\$379.00
Disk Drive cables made to order	P.O.A.



Also available without cutouts on front panel

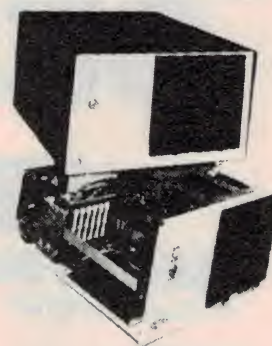
## MINI-SYSTEM + (1/2MB +)

Computer System with 5 1/4" Single Sided Drives (uses TEAC FD-50A Disk Drives) Terminal not included.

A&T (6 slot)	\$3048.00
A&T (8 slot)	\$3073.00

## MAINFRAMES

### S-100 MAINFRAME FOR DUAL 8" DISK DRIVES



AT LAST! A desk top enclosure that will accommodate a S-100 bus system and two 8" disk drives. The MF+MD mainframe is the most versatile dual 8" mainframe on the market. It will accommodate 6, 8, or 12 slot card cages using the Silence + motherboards. Just add a CPU, memory board, disk controller and terminal and you have an inexpensive, high quality computer system.

### FEATURES:

- Accommodates 8" standard disk drive (801R, DT-8, etc.)
- IEEE S-100 Silence + 6, 8 or 12 slot motherboard available. (See motherboard description at left.)
- Keyed power switch.
- Reset switch on front panel.
- Anodized 6, 8 or 12 slot cages.
- Quiet fan provides cool system operation featuring filtered positive air pressure. User may add two additional fans for the 12 slot if required.
- Detachable line chord plugs directly into EMI filter for electrical noise suppression.
- 16 DB25 cut out
- 2 50 pin plug connector cut outs.
- 2 DD55 cut outs.
- Dimensions 9 5/8" x 17" x 21" (HxWxD)
- Power supply +8V@25A/+16V @ 5A/+5@2.5A/-5@5A/+24V@3A
- Input Voltage 110-113VAC/220-240VAC 50-60 Hz

QTCMFDD	without Motherboard	\$575.00
QTCMFDD6	with 6 Slot Motherboard	\$625.00
QTCMFDD8	with 8 Slot Motherboard	\$650.00
QTCMFDD12	with 12 Slot Motherboard	\$700.00
QTCB	Bare Metalwork	\$175.00

## PERIPHERALS +

We have fantastic specials on printers, terminals, plotters and disk drives. Call or write for details and pricing. Here are some examples:

YD-174 8" DS/DD Drives	@ \$625.00
2 for	\$1200.00
VIEWPOINT Terminal 80x24 detachable keyboard	\$995.00
Hazeltine Esprit 80 x 24	
Green Screen. Emulates other terminals.	
Optional Graphics. Best value	\$975.00
WATANABE 6 colour plotter	\$1295.00
TEAC and MPI mini drives, 40 or 80 track.	
Single or double sided. Our prices are too low to advertise!! We carry a complete range of cabinets and power supplies for 5 1/4" and 8" drives for single and dual drives.	
ITOH DAISYWHEEL 25 cps (parallel).	\$1500.00
Serial or 40 cps optional.	
ITOH M8510 Graphics Printer	
Parallel version (serial optional)	\$ 795.00

## LIMITED STOCKS LIMITED STOCKS!!

64K static RAM	• Full IEEE 696
Intermix RAM	• Assembled and tested, with 64K
and EPROM	or 256K
200 nano. Very low power.	
64K A&T \$495	CR256-64 \$795.00
	CR256-256 \$995.00

PLACE YOUR BANCKARD ORDERS BY PHONE!! WE DELIVER OVERNIGHT ANYWHERE IN AUST. FOR \$350 up to 4kg. Or \$10 up to 10kg.

WE HAVE A COMPLETE RANGE OF S100 BOARDS AND MICROCOMPUTER PRODUCTS IF THE PRODUCT YOU REQUIRE IS NOT ADVERTISED DUE TO LACK OF SPACE PLEASE CALL OR WRITE.

OUR 1982 CATALOGUE IS NOW AVAILABLE. SEND S.A.E. FOR FREE COPY!!

PRICES DO NOT INCLUDE SALES TAX OR DELIVERY, AND ARE SUBJECT TO CHANGE WITHOUT NOTICE.





# SERIES 5000

As designed by ETI



## SERIES 5000 PREAMPLIFIER — SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, -1 dB Low-level input — conforms to RIAA equalisation, $\pm 0.2$ dB
Distortion:	1kHz < 0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat > 100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 $\mu$ V input signal: >71 dB flat >75 dB A-weighted.



*N.B. Picture is only of original heatsink supplied with this project. Our one is tapped from the rear so that no screw heads are visible. New picture next month.*

Please note that the "Superfinish" Heatsink for the power amp was designed and developed by Ron Irving Electronics and is being supplied to other kit suppliers. This product cost \$1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

## SERIES 5000 POWER AMPLIFIER — SPECIFICATIONS

Power output:	100W RMS into 8 ohms ( $\pm 55$ V supply).
Frequency response:	8 Hz to 20 kHz, +0 -0.4 dB 2.8 Hz to 65 kHz, +0 -3 dB NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	-100dB below full output (flat).
Noise:	-116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a $\pm 56$ V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

### EXTRA FEATURES OF OUR KITS POWER AMPLIFIER

- KIT PRICE \$279.00 P & P \$8.00
- 1% Metal Film Resistors are used where possible
  - Prewound Coils are supplied
  - Aluminium case as per the original article
  - All components are top quality
  - Over 200 Kits now sold
  - We have built this unit and so know what needs to go into every kit
  - SUPER FINISH Front panel supplied with every kit at no extra cost to you
  - We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. two weeks after placement.

The price is only \$399.00

\*All parts available separately for both kits.

### PREAMPLIFIER

KIT PRICE \$239.00 P & P \$8.00

- 1% Metal Film Resistors are supplied
- 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes)
- English "Lorin" Switches are supplied no substitutes as others supply
- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
- Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the P.A.

All the above for only \$399.00



## SERIES 4000 SPEAKERS FROM ETI

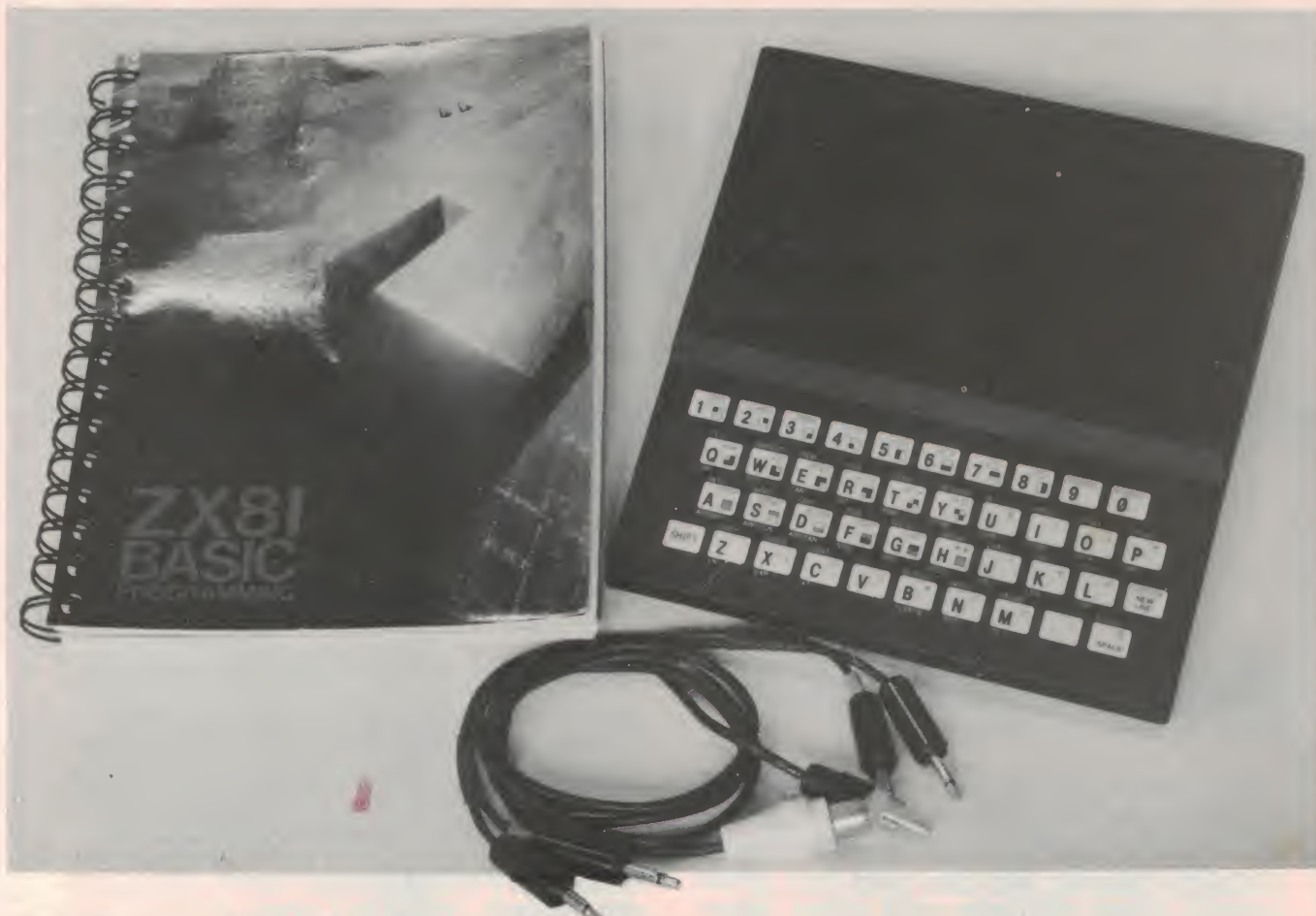
### SERIES 4000/14-WAY SPEAKERS

A no compromise, top-line system designed by David Tilbrook and described in the February 1980 ETI. Those who own them or have heard them universally praise them for clarity of sound, superb stereo imaging and smoothness of response. Employing Philips' latest range of low distortion drivers and a specially-designed crossover network (another Tilbrook masterpiece) these speakers are the equal of other systems costing up to three times the price. The 4000/1 will handle 100 W continuous, up to 400 W peak. PLEASE CHECK PRICES AND AVAILABILITY

# ROD IRVING ELECTRONICS

425 HIGH STREET NORTHCOTE 3070 MELBOURNE (03) 489-8131





# Sinclair's little beauty — the ZX81

Phil Cohen

The ZX81 is a remarkable machine for many reasons — not the least of which is its price; it must surely be the cheapest of the BASIC machines. We asked Phil Cohen to review it.

I REMEMBER FROM my adolescence (I'm not as old as I feel) the first of the Sinclair devices to hit the British market. These included a matchbox-sized radio, a calculator (which hit *before* the Japanese ones), a digital watch kit at a fraction of the cost of competitive ones, and so on.

Although these may raise a yawn nowadays, at the time they were at the forefront of the market. Imagine the reaction of the public to the *first* digital watch, the *first* calculator — real 'Boys' Own Paper' stuff.

Sinclair entered the computer market with a little development kit based on the SC/MP processor, then moved very quickly up-market with the ZX80 (the forerunner of the ZX81).

I remember my reaction on first seeing the ZX80 advertised — I looked at the date of the magazine to see whether it was an April edition. I really believed that it was a joke! I didn't think anyone could put so much into so small a package at so low a price.

The ZX80 had a couple of dozen chips and primitive BASIC capabilities. The

ZX81 has as powerful a BASIC as many other machines on the market, and the British version has five ICs (ignoring the three-terminal regulator). The Australian version has seven, but the extra two are 'piggyback' add-ons to allow for the differing TV standards.

## Amazing!

To look at, the ZX81 seems to be a mock-up of itself — it weighs about as much as a paperback, it has no moving parts, it has no trailing wires, its case is plastic. ►



# MICROCOMPUTER OWNERS & BUYERS

---

## ***IMPORTANT NOTICE***

---

### GREAT NEWS FROM COMPUTER COUNTRY



We are No. 1 in Victoria for Apples. We are the oldest apple dealer in Victoria and are a Factory authorised Apple Service Centre. We can give you great prices, great delivery and great after-sales service! — Why go elsewhere?

#### INTRODUCING THE NEC PC-8000 PROFESSIONAL COMPUTER

It combines the most wanted features of existing micros with new features you have always been looking for. These features include 80 column screen, five user programmable keys, Z-80 equivalent chip, Access to CP/M software and N-Basic by Microsoft.

The NEC Professional Computer gives you much more for your money than almost any other micro on the market.

## **MAKE A SMART MOVE COME TO COMPUTER COUNTRY**

338 Queen Street,  
Melbourne Vic 3000

329-7533

\* Please call us to get on our free mailing list for future information on special sales and free tickets for our upcoming microcomputer seminars.

In Queensland contact: Computer City, 600 Old Cleveland Road,  
Camp Hill (Brisbane) QLD 4152. Tel (07) 398 6579



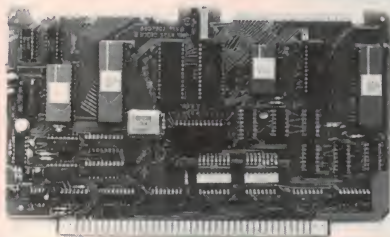
## 68PDC04

### Processor and Disc Controller Card.

- Accepts Motorola 6802 and 6809 micro-processors
- Monitor available
- Single 2716 (+5V) or 2732 EPROM for each microprocessor
- 1k scratchpad RAM
- Extended addressing range
- Software/Hardware trace facility
- Full RS232 with handshaking
- Parallel port with control lines
- Single/Double density, 5¼/8 inch, single/Double sided Floppy Disc Controller interface
- Motorola Exorciser Bus compatible. ONLY \$95

## 68GPB03

### The ultimate in microprocessor I/O.



- 16 channel ADC (with 12 bit resolution).
- 2 channel DAC (with 8 bit resolution).
- 32 bit programmable I/O (2 x MC6821).
- 6 programmable timers (2 x MC6840).
- 2 serial synchronous/asynchronous interfaces
- Hardware and software programmed baud rate generation.
- High quality double-sided PCB.
- Motorola Exorciser Bus and outline compatible
- Occupies only 32 consecutive bytes.

## 68MBO2

### Two boards in one

- 16K RAM (2114) expandable in 1K increments.
- 16K EPROM (2716, plus 5V) expandable in 2K increments.
- Two 8K RAM blocks selectable in 8K increments.
- Two 8K EPROM blocks selectable in 8K increments.
- High quality double-sided PCB.
- Motorola Exorciser Bus and outline compatible
- Motorola Exorciser Bus compatible.

### SPECIAL ONLY \$60\*

\*All prices add 17.5% S/T (if applicable) and subject to change without notice. P&P \$2.

## MICRO GEAR

3 Coora Place, Churchill, VIC. 3842  
Phone (051) 67-1498 A.H. (051) 22-1157

## EPROM PROGRAMMERS

The addition of the "COPICAT" Series to our fast expanding range of Eprom Programmers now allows users to select a professional quality Programmer specifically designed for their Micro System type.

### Features (All Models):—

- \*Program all popular EPROMS from 1K to 8K BYTE size. e.g. 2708, 2716, 2516, 2732, 2532, 2764, 2564 etc. 8K BYTE CAPACITY means that our Programmers provide for both your current AND future needs!
- \*Powerful, EASY TO USE, Software Controller Module fits your System to drive the Eprom Programmer. Performs ERASE CHECK, PROGRAM AUTO-VERIFY and READ functions. This Software is available in 2516 Eprom or on Audio Cassette Tape ready to operate in your System.

Models available for:—

### APPLE II

COPICAT II connects directly to any APPLE II I/O Slot.

Price (all inclusive).....\$380\*

### COMMODORE PET/CBM

COPICAT I connects directly to the COMMODORE User Port.

Price (all inclusive).....\$395\*

### TRS-80

COPICAT III connects directly to the TRS-80 Expansion Port.

Price (all inclusive).....\$370\*

**\*\*ALL COPICAT Series Eprom Programmers are supplied complete, ready to use, with case, power supply, connecting cable for your System, Controller Software and Manual**

### SS-50 BUS (GIMIX, SSB, SWTPC etc)

Model NEP-3/AS, fully assembled and tested PCB for direct insertion into any 30 Pin SS-50 I/O Slot.

Controller Software (specify 6800 or 6809) in 2516 Eprom or Cassette Tape to K.C. Standard.

Price (incl. Software) .....\$292\*

### UNIVERSAL MODELS

Model NEP-3/AB interfaces to Rockwell 6502 and Motorola 6800/6809 uP BUS.....\$345\*

Model NEP-3/AP interfaces to TTL Parallel I/O Port (8 data, 2 control lines)\$325\* NEP-3 Models:— Price includes case, power supply. Interface Cables & Software extra.

\*Prices: + 17½% S/T where applicable  
Delivery: Regd Post & Pack .....\$5  
Courier .....\$15

For further information please write or phone:—

## NUTEK SALES

P.O. BOX 95  
EASTWOOD N.S.W. 2122  
Ph. (02) 871-7042

magmedia magmedia

## Verbatim Datalife

Means 7 data-shielding improvements for greater durability, longer life

World's largest manufacturer of quality Digital Recording Media. Supplying the broadest range of Diskettes and Mini Diskettes, Cassettes and Mini Cassettes, Cartridges and Mini Cartridges for scientific, business and personal computer applications.

All Verbatim Media sets industry standards for long-life, error-free data storage, now with Datalife.

That's why Verbatim storage media is the choice of leading manufacturers of Digital Systems. Now it's available to you when you put your data into storage you get it back Verbatim!!

Now a comprehensive manufacturing operation is located in Melbourne, Australia. Complete laboratory and QC test facilities are available to provide customer service and testing for most Verbatim products.



Complete range available  
Verbatim 8" Flexible Disks  
Verbatim Cassettes  
Verbatim Data Cartridges  
Verbatim Optima Series Alignment Diskettes  
Verbatim 5¼" Mini Disks  
Verbatim Mini Cassettes  
Verbatim Mini Data Cartridges  
Verbatim Test Instruments

Sole Australian distributor

**magmedia**  
Magmedia service puts the customer first

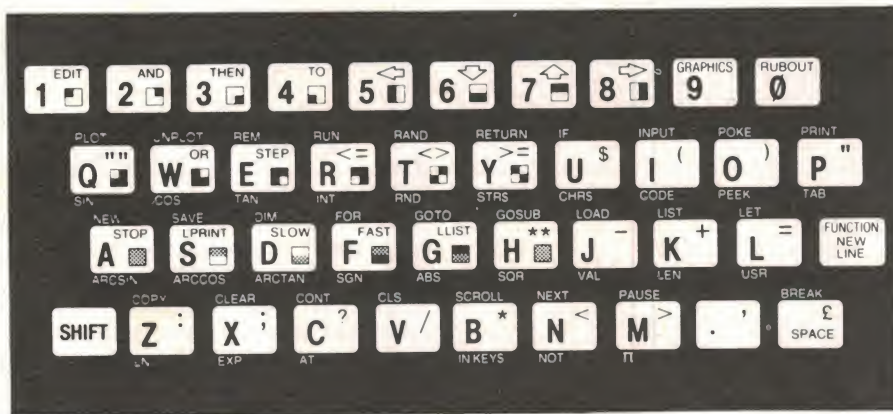
**SYDNEY:** 5 Apollo Place Lane Cove NSW 2066  
Phone (02) 428 1100 Telex AA22703

**MELBOURNE:** 100 Park Street South Melbourne Phone (03) 699 9688 Telex AA35968

**BRISBANE:** 123 Leichhardt Street Brisbane QLD 4000 Phone (07) 229 1941 Telex AA42367

**CANBERRA:** 25 Lonsdale Street Braddon ACT 2601 Phone (062) 48 6751 Telex AA22703





The ZX81 keyboard, just a little smaller than lifesize. It's made for small fingers. The editor's son, Jamey, boasts he can type faster than his father on this one!

The keyboard looks as if it has simply been printed onto the front of the case. In fact, it's 'elastomeric', made up of a conductive rubber sheet over a set of printed circuit contacts. When you press the sheet down, it makes contact with the circuit board. It's just difficult to believe that it is what it's claimed to be.

## Hardware

Input and output for the ZX81 could not be simpler — literally. Output is direct to a TV set (not a monitor), and there are a couple of sockets for connection of a cassette recorder for program and data storage.

The power for the ZX81 comes from a 9 V dc plugpack — a combined mains plug, transformer and power supply. This plugs into the side of the computer. And that's it! Unless you want to add peripherals.

There is an exposed section of edge connector pads at the top of the machine designed for the addition of the two peripherals so far released. One is a RAM pack which brings the total memory from its existing, rather limited, 1K up to a more sensible 16K. It costs \$150. The other peripheral available is a printer, which has only just been released here. It costs \$175 and features full alphanumerics plus graphics and prints 32 characters to the line, nine lines every 25 mm.

The processor used in the ZX81 is a version of the ubiquitous Z-80, made by NEC and designated '780-1'.

The keyboard is laid out in the normal typewriter 'QWERTY' manner — although *much* smaller than a typewriter keyboard. One user I heard from (he's ten) said it was just the right size.

I, unfortunately, have normal-sized adult hands, so it's a bit small for me. In fact, that's one of the few criticisms I have of the ZX81 — you can't type on it, you have to use it like a calculator.

In fact, there's no 'feedback' to tell you that you've pressed a key — so you have to keep moving your eyes from the

screen to the keyboard and back again. After a while (particularly during program entry) this gets very tedious indeed, but I suppose that most of the buyers (myself included, if I'd bought one instead of being loaned one for review) would rather have the cash than a better keyboard. It's very tempting for reviewers to catalogue the facilities that are missing from a device while at the same time forgetting that if they had been included, the buyer would inevitably have to pay. The incredibly low price of the ZX81 (about \$250 complete, built and tested) is one of its main attractions.

The other difference between the ZX81 keyboard and those more normally found on computers is the fact that the key functions don't stop at the letters of the alphabet.

## Statement Entry

This 'doubling up' of functions is due to the extremely clever way in which Sinclair have arranged their program entry.

Say you want to enter the line "10 PRINT A". In most computers, you would press the '1' key, then the '0' key ... through to the 'A' key at the end of the line. On the ZX81 you start with the line number, then simply press the 'P' key. Up on the screen comes "10 PRINT". There's no need to type the rest of the word in. Then you press the 'A' key (no need for a space — the computer supplies that).

The ZX81 BASIC is arranged so that the first word on each line is a keyword (like PRINT, FOR etc). So when you press the 'P' key, the machine *knows* that you mean PRINT, because the next entry *must* be a keyword. On the keyboard, the word PRINT appears over the 'P' key.

In fact, nearly all of the keys have a keyword associated with them. One consequence of using this system is that the old 'LET' statement (introduced in the very first version of BASIC, nearly 20

years ago) is resurrected. Most systems these days allow you to miss out the word LET in an assignment statement.

Another consequence of the system is that the software doesn't have to check the spelling to see if it's a keyword (as in other systems, where the entry is held in memory as a series of alphanumeric characters, interpreted only at run-time). Each of the keywords is entered and stored as a single character (although it appears spelt out on the screen). This is not only faster, it also saves memory.

There is also a SHIFT key, and a combination of other keys (FUNCTION and GRAPHICS) to select other options from the same letter key. In fact, some of the letter keys have *five* different functions crammed onto their ultra-small face!

The ZX81 is not for those who have trouble with small print!

## Display

The display on the screen is rather unusual for two reasons: the first is that all characters are shown normally as black on white. I found this rather pleasant, and less of a strain on the eye than the normal white-on-black.

The second rather unusual feature is that there is no automatic scrolling of the display. In most systems, when the PRINT statements in the program have put enough lines out to fill the available space, the screen 'scrolls' up one, leaving a blank line at the bottom for the next line of output. The ZX81 does not have this feature — and in fact, if the PRINT statements try to put too much onto the screen, an error will result and the program will halt!

There are two ways to get round this. One is a SCROLL statement, which moves the screen up one line. The second is the CLS statement, which clears the screen.

It is rather surprising that Sinclair have chosen not to implement the automatic scroll — perhaps they have some good reason. I can't think of one.

The character set consists of upper-case letters, numbers, and the very minimum of other symbols. In fact, Sinclair have kept the character set so small that I think some users may run into problems. For example, the symbol for multiplication is an asterisk '\*', and the symbol for exponentiation (i.e. raising to a higher power) is two asterisks '\*\*'. Now, it is quite possible to put two of the multiplication symbols into a line side by side. However, this is not interpreted by the computer as exponentiation. That has to be the special '\*\*' symbol. Unfortunately, there is no easy way that the user can tell the difference between the two on the screen. So it is quite possible to do as



I did — to type two multiplication symbols to mean exponentiation, and then wonder why it didn't work.

## Syntax Checking

Each line of the program is checked for syntax as it is entered. Not only does this mean that problems will be shown up as they occur, but also that the machine doesn't have to check the syntax again as it runs the program.

The graphics symbols are fairly complete — allowing each character position to be split into four segments, each of which can be black or white.

There are also symbols which allow shading of each character position, split horizontally into two segments (see photo of the keyboard). Each of the symbols in the alphanumeric set can be shown 'reversed', also.

As each line of program is entered, it appears on the screen in its correct position. So the normal method of looking at the program — a LIST command which scrolls the listing onto the screen — is not used.

Instead, the bottom couple of lines of the screen are an 'entry area', where the cursor appears. The top part of the screen then shows whatever part of the program the last line was entered into.

In fact, this method of entry is very

much easier to use than the normal 'scroll' method. It means that you can actually see the program change as you enter lines — this is very useful for beginners, who sometimes have trouble visualising what is happening inside the machine.

There is also an EDIT facility — one of the already-entered lines can be called into the bottom part of the screen and modified, before being replaced in the main part of the program.

The operating system has a couple of features which are unique to the ZX81 — one of these is the ability to run in two modes — SLOW and FAST.

In the SLOW mode, the machine gives a 'flicker-free' display — the screen display is constant while calculations are in progress.

In the FAST mode (about four times as fast), the screen blanks while the machine is calculating, only coming on when it is paused for input (or during execution of the PAUSE command). This is because Sinclair are using the CPU to output the display!

The cassette saving routines have the ability to label the programs with an alphanumeric string, and to search for that string when the program is read off tape, only starting to load when they find the right program.

Another unusual feature is that when

a program is saved, all the current variable values are saved, too. This is nice for fitting very 'tight' programs into the machine — the data initialisations do not need to take up *any* memory. The only space they need would already be used by the variables themselves.

## Manual

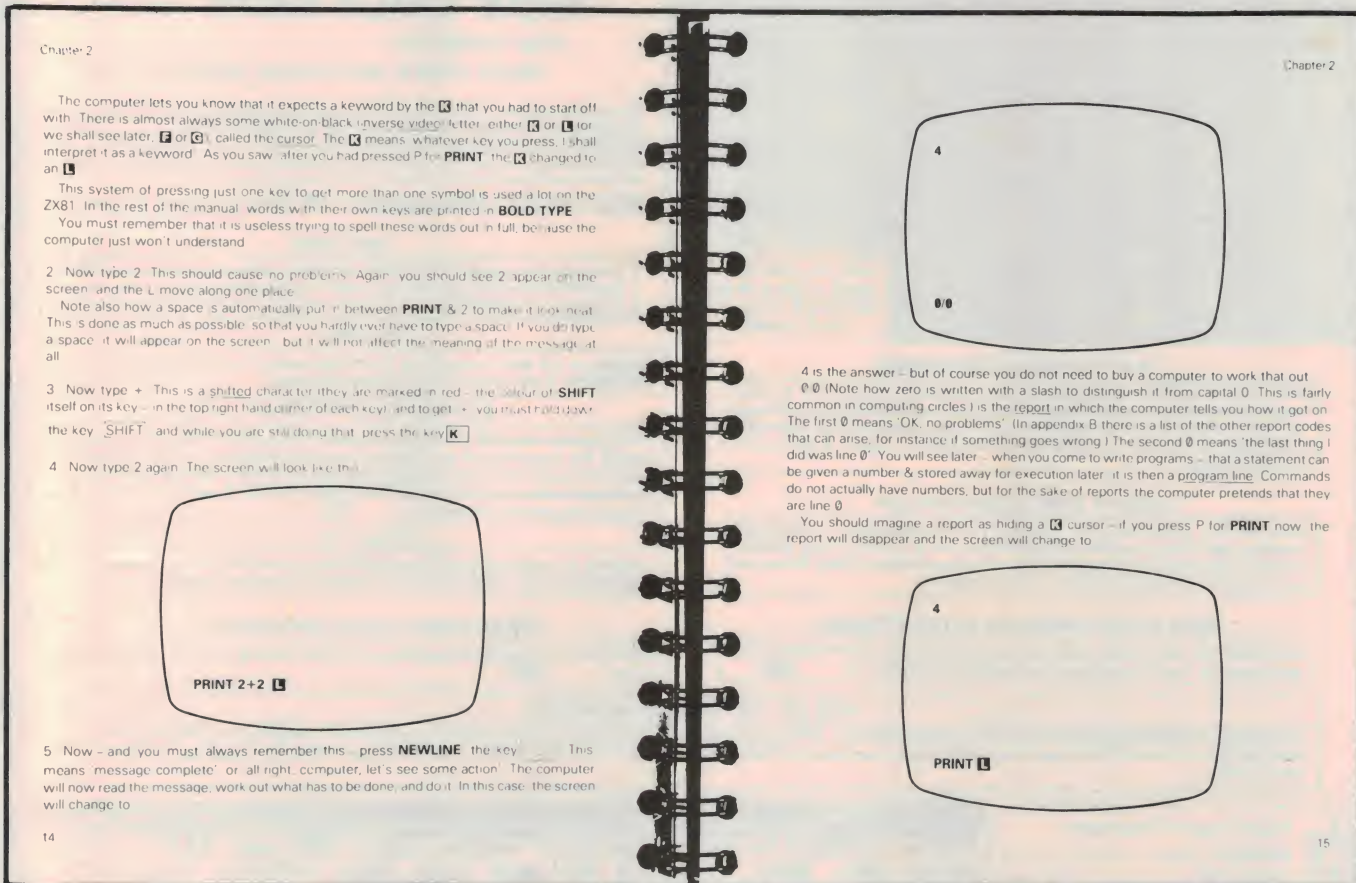
The documentation that comes with the ZX81 is really excellent — the author, Steven Vickers, has taken a very down-to-earth approach, and the whole thing (over 200 pages of it) hangs together very nicely indeed. It is well peppered with explanatory examples, and is written in an easy style that will not confuse or frighten anyone. It's also spiral bound, so that it will lie flat while you copy programs from it!

The manual for a machine like the ZX81 is almost as important as the hardware itself — it is, after all, primarily a teaching machine.

The only thing that's missing from the manual is any sort of comprehensive hardware details. I suppose, though, that given the probable audience this would not be worthwhile.

The manual not only describes the ZX81 BASIC in loving detail, it also goes on to describe the internal software in some depth, including a full listing of ▶

An example of how the manual is set out. It's one of the clearest, best-written manuals we have ever seen and perfectly suited to the user, beginner or not.





DON'T FORGET TO CHECK WITH US BEFORE YOU BUY A COMPUTER OR OTHER PRODUCTS

# ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA

## 16K EPROM CARD-S 100 BUSS



**\$89.50**  
**KIT**

**BLANK PC BOARD**  
**\$49**  
**USES 2708's!**

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

**OUR 450 NS 2708'S**  
**ARE \$5.90EA. WITH**  
**PURCHASE OF KIT**

**ASSEMBLED**  
**AND FULLY TESTED**  
**ADD \$36**

## \$100 COMPUTER PRODUCTS

### 32K S-100 EPROM CARD

**NEW!**



**\$99.95**

**KIT**  
**USES 2716's**  
**Blank PC Board - \$59**  
**ASSEMBLED & TESTED**  
**ADD \$30**

**SPECIAL: 2716 EPROM's (450 NS) Are \$5.90 EA. With Above Kit.**

- |  |  |
|--|--|
| <b>KIT FEATURES</b>                          |  |
| 1 Uses +5V only 2716 (2Kx8) EPROM's          | 7 Any or all EPROM locations can be disabled                   |
| 2 Allows up to 32K of software on line!      | 8 Double sided PC board solder-masked, silk-screened           |
| 3 IEEE S-100 Compatible                      | 9 Gold plated contact fingers                                  |
| 4 Addressable as two independent 16K blocks  | 10 Unselected EPROM's automatically powered down for low power |
| 5 Cromemco extended or Northstar bank select | 11 Fully buffered and bypassed                                 |
| 6 On board wait state circuitry if needed    | 12 Easy and quick to assemble                                  |

**\* \* \* AVAILABLE AGAIN \* \* \***



- 16K Dynamic RAM Board
- Fully Expandable to 64K
- Assembled, tested and guaranteed
- \$100 Compatible

16K Dynamic RAM Board assembled and tested: Special \$289 plus tax (4mHz) \$299 plus tax (4mHz) This must be the best offer available on quality tested dynamic RAM boards.

32K Assembled and tested **\$289 plus tax (4mHz)**

48K Assembled and tested **\$309 plus tax (4mHz)**

64K Assembled and tested **\$329 plus tax (4mHz)**

## 16K STATIC RAM KIT-S 100 BUSS

**KIT \$179**  
**A&T \$199**



### KIT FEATURES

- 1 Addressable as four separate 4K Blocks
- 2 ON BOARD BANK SELECT circuitry (Cromemco Standard) Allows up to 512K on line
- 3 Uses 2114 (450NS) 4K Static Rams
- 4 ON BOARD SELECTABLE WAIT STATES
- 5 Double sided PC Board with solder mask and silk screened layout Gold plated contact fingers
- 6 All address and data lines fully buffered
- 7 Kit includes ALL parts and sockets
- 8 PHANTOM is jumpered to PIN 67
- 9 LOW POWER under 1.5 amps TYPICAL from the +5 Volt Bus
- 10 Blank PC Board can be populated as any multiple of 4K

**BLANK PC BOARD W DATA \$55**  
**LOW PROFILE SOCKET SET \$22**  
**SUPPORT IC'S & CAPS \$29**  
**ASSEMBLED & TESTED: ADD \$30**

**OUR #1 SELLING**  
**RAM BOARD!**

## 16K STATIC RAM SS-50 BUSS

**PRICE CUT!**

**\$199 KIT**  
**A&T \$219**

**FULLY STATIC**  
**AT DYNAMIC**  
**PRICES**



**32K STATIC ALSO AVAILABLE**

**FOR SWTPC**  
**6800 BUSS!**

**BLANK PC BOARD - \$49 COMPLETE SOCKET SET -**  
**\$22 SUPPORT IC'S AND CAPS - \$45**

## NOW A \$99 Computer!

**Plugs into any TV!**  
**ETI 660**

No one would have believed it a few years ago. Features include: colour capability, operates from optional 9V plugpack, 1K memory expansion to 3K on-board, single board construction, cassette interface, audio output (play tunes), simple to program (uses Cric-It). Expansion projects coming up include: ASCII keyboard, light pen, games software etc. (So we are told)

Starts Kit (17K RAM, 8K I/O video) \$99.00  
9V 1amp Plug Pack to test \$12.50  
RAM EXPANSION (add to PCB) \$15.00  
Ag with all new kits, please drive first to check chips



**ETI636 7 SLOT MOTHERBOARD WITH ACTIVE TERMINATION**  
Kit of Parts \$89.00 Assembled and tested \$115.00 inc tax.  
**RITRON COMPUTER GRADE POWER SUPPLY +5V Reg. 10A, ± 16V Unreg. Kit of parts \$89.90 inc tax A&T \$109.00 inc tax**  
Write for list of other power supplies. Tax free prices also available.

## SINGLE BOARD COMPUTER KIT NOW ONLY \$649 + TAX (17½%)

Also available,  
Blank PCB's with Roms **\$295 + Tax.**

**THE FERGUSON PROJECT:** Three years in the works, and maybe too good to be true. A tribute to hard headed no compromise, high performance. American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure, and you have a total Business System for about 1/3 the cost you might expect to pay.

**FEATURES: (Remember, all this on one board!)**

### 64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

### Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERRUPTS. Fully buffered and runs 8080 software

### SERIAL I/O (OPTIONAL)

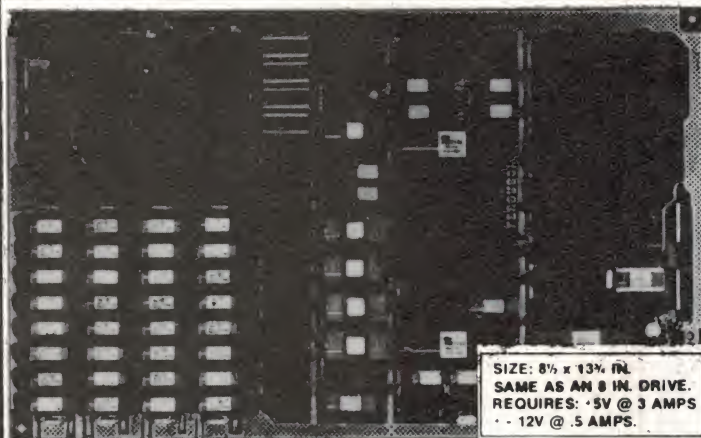
Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: **\$95**

### BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

### REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: **\$25**



**SIZE: 8 1/2 x 13 1/2 IN.**  
**SAME AS AN 8 IN. DRIVE.**  
**REQUIRES: +5V @ 3 AMPS**  
**- 12V @ .5 AMPS.**

### 24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control! Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

### FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M 2.2.

### FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: **\$45**

### PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

Mail Orders  
Welcome

Please debit my Bankcard.

Bankcard No. \_\_\_\_\_

Expiry Date \_\_\_\_\_

Name \_\_\_\_\_

Signature \_\_\_\_\_

General enquiries (03) 489-8131. Mail order enquiries (03) 481-1436. Ritronics Wholesale (03) 489-7099. (Tax Exempt Enquiries)

**Prices subject to change without notice. Send 60¢ and SAE for free .**  
**Price lists. MAIL ORDERS PO BOX 235, NORTHCOTE, Vic. 3070. t**  
**Minimum pack and post \$5.00. Telex AA38897.**  
**PLEASE WRITE OR RING FOR THE BEST POSSIBLE PRICES ON DISC DRIVES,**  
**PRINTERS AND OTHER COMPUTER COMPONENTS.**



the system variables and their interpretation, and a section on how to use machine code programs with BASIC.

## Using it

Now we come to the most important part — how the machine performs.

I didn't try any 'benchmark' programs on the ZX81 — there's not much point, because all they would show is that the machine is significantly slower than almost any other on the market.

I say again — it's a teaching machine. So the speed doesn't *really* matter.

I wouldn't recommend the ZX81 to someone who wants to do a lot of number-crunching, though — you'd be better off with a programmable calculator.

The display is sharp enough to be read without too much strain — even on my little portable. The characters are a little 'blocky', but not outrageously so.

Apart from the problem I mentioned earlier about the keyboard having no feedback, the only other major trouble in using the ZX81 is that 1K is really rather small — even with one character per keyword.

Executing DIM A(150) is enough to get you right into trouble. Things start to move about on the screen as you enter lines of program. I suppose that's understandable, though — they *did* manage to squeeze the whole thing into a very small case.

On the whole, ZX81 is a rather frustrating machine to use — this is partly a combination of the slowness and the keyboard feedback problem. The fact that some of the characters need up to five key presses to enter them doesn't help, either.

Then again — if it's the only computer that you can afford, and it's the first one that you've used, then it's not likely to trouble you.

## ZX81 BASIC

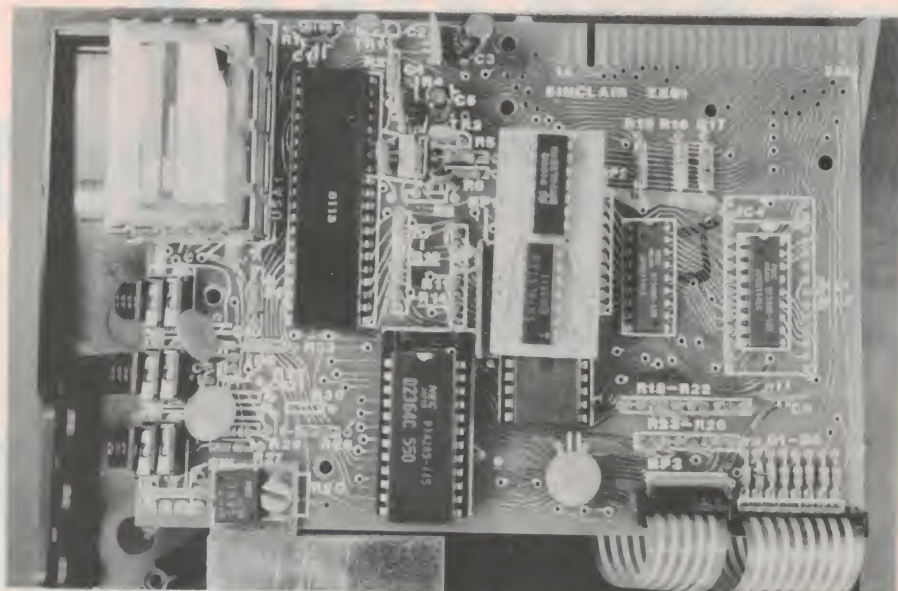
Finally, I've included a list of the commands and features of the ZX81 BASIC, so that you can see that the ZX81's language is every bit as comprehensive as that of other machines on the market.

**Variables** may have an alphanumeric name of any length, starting with a letter and continuing with letters and numbers — and *spaces*! This is due to the unique keyword entry method.

**Values** are stored to 9 digits, with a range between about  $10^{-38}$  and  $10^{38}$ . (That's from real-tiny-minute to gi-normous).

**Array** names are a single letter, and arrays may have any number of dimensions of any size.

**String arrays** are allowed — but all of the strings in the array are the same length.



The inside. That's all — true!

**String variables** are any length, but the string name is only a single letter.

**Functions** supported include: absolute value, arccos, AND, arcsin, arctan, CHR\$, CODE (the same as ASC in other BASICS — but it's not ASCII), cos, x<sup>e</sup>, INKEY\$ (gets a key press from the keyboard), integer part of a number, length of a string, 1n, NOT, OR, PEEK, pi, random number, sign of a number, sin, square root, STR\$, tan, user machine code routine call, and VAL.

**Statement types** are:

CLEAR deletes all variables

CLS clears the screen

CONT after 'break', continues execution

COPY sends a copy of the screen contents to the printer

DIM dimensions arrays

FAST sets machine into fast mode (see text)

FOR . . . TO . . . STEP forms a loop (the variable used must have only one letter in its name)

GOSUB sends program to a BASIC subroutine

GOTO sends program to a line number (line number may be expressed as an expression)

IF . . . THEN allows changes in program flow — but multiple statements per line are not supported

INPUT allows the user to input an expression (!)

LET is required for assignment statements

LIST allows the user to call up any part of the program on the screen's display area

LLIST sends it to the printer

LOAD searches for the program name on the tape, then loads it

LPRINT sends output to the printer

NEW initialises the whole system

NEXT ends a FOR loop

PAUSE stops the program for a set period from 1/50 of a second to about 10 minutes

PLOT makes one quarter of a character position in the position specified go on

POKE allows the program to alter memory directly

PRINT puts information onto the screen. Features supported are: comma (giving a fixed tab), semi-colon (at the end of the statement, preventing line feed and carriage return) and TAB

RAND allows randomisation of the RND variable sequence

REM for remarks

RETURN ends a subroutine

RUN runs a program. RUN (line number) starts the program from that line number

SAVE puts the program onto tape, with a name of any length

SCROLL moves all the lines in the display area up one

SLOW puts the machine into slow mode (see text)

STOP halts execution

UNPLOT turns off one quarter of a character position in the position specified

## Summary

The ZX81 is a very high value-for-money machine. It's designed as a teaching machine, and at a price around \$250 is very well targeted.

It is not a machine for those who have number-crunching applications in mind. For that it is rather slow and a bit awkward.

It does, however, have almost all the advanced features found on other BASIC systems. Having mastered the ZX81, you will be able to drive almost any other machine after a couple of days.

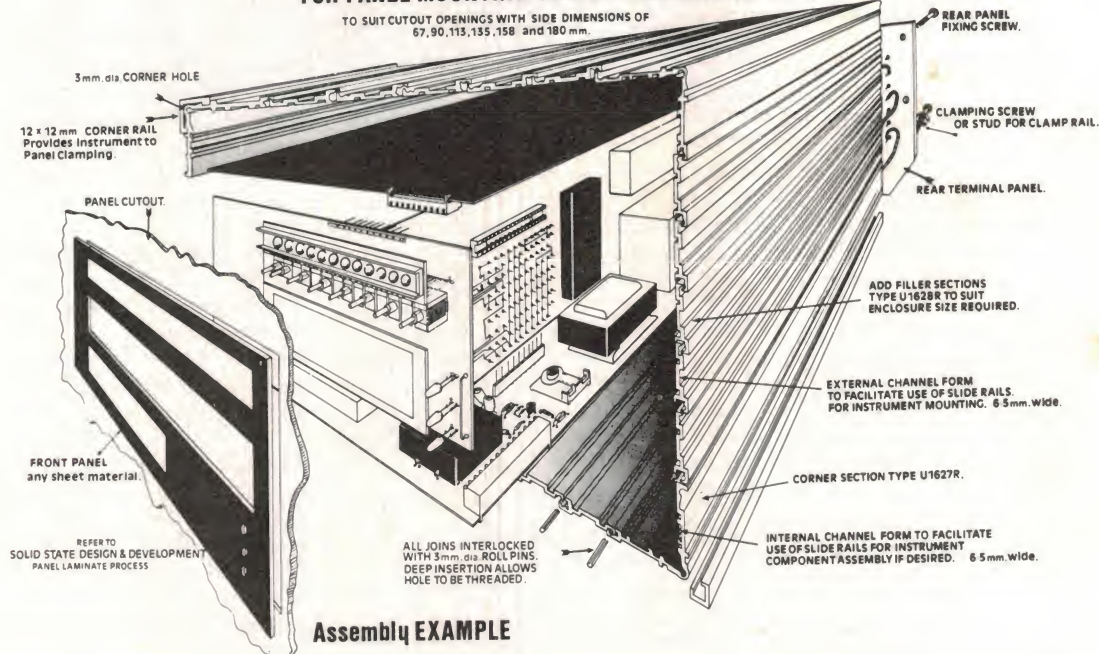
It would make a tremendous birthday present for anyone from age 10 upwards. For a week's wages, you would be giving a package that contained many years of future for the recipient.



# PACKAGING? PRESENTATION? PROTECTION?

\*NEW DIMENSIONS  
\*NEW ANSWERS  
\*NEW APPROACHES

## SERIES 1 EXTRUSIONS FOR PANEL MOUNTING CONTROL INSTRUMENTS



This expanding series of extrusions was expressly designed to facilitate the easy manufacture and assembly of modules and instruments intended to conveniently mount in control panels, SPECIFICALLY TO CLAMP ABOUT A SHEET OF MATERIAL WITH A RECTANGULAR CUT-OUT.

PARTICULAR ATTENTION WAS GIVEN TO TWO REQUIREMENTS.

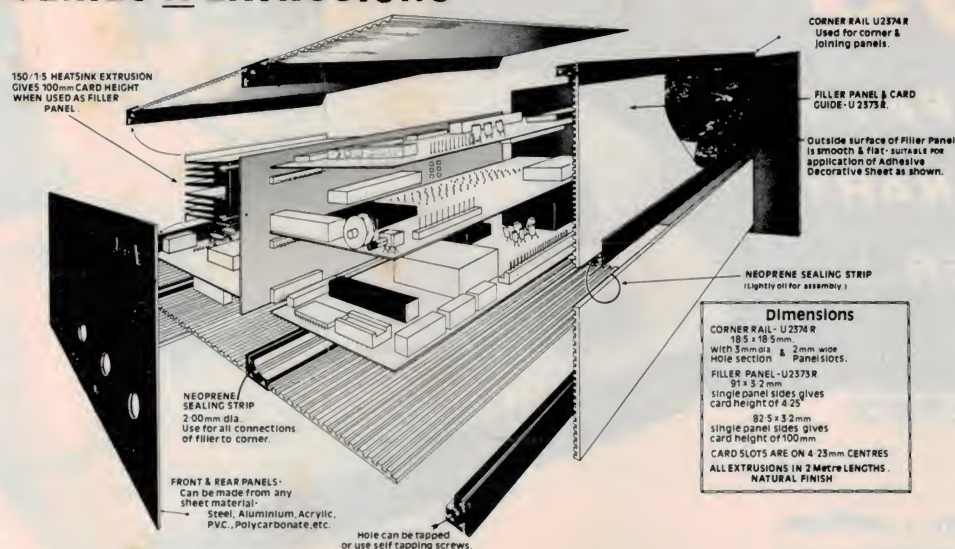
1. Cut-out sizes conform to the DIN standard of 22.5 mm multiples eg. 45 x 90 mm.
2. Internal fixtures be able to accommodate a card spacing of 0.50" and 0.40" ie. multiples of the 0.10" standard.

ADDITIONAL FEATURES WERE INCORPORATED TO FACILITATE EXTERNAL AND INTERNAL SLIDE RAILS AND THE PROVISION OF HOLES READY FOR THREAD TAPPING OR THE DIRECT USE OF SELF THREADING SCREWS.

# MINITool Aust. Pty. Ltd.



## SERIES II EXTRUSIONS-



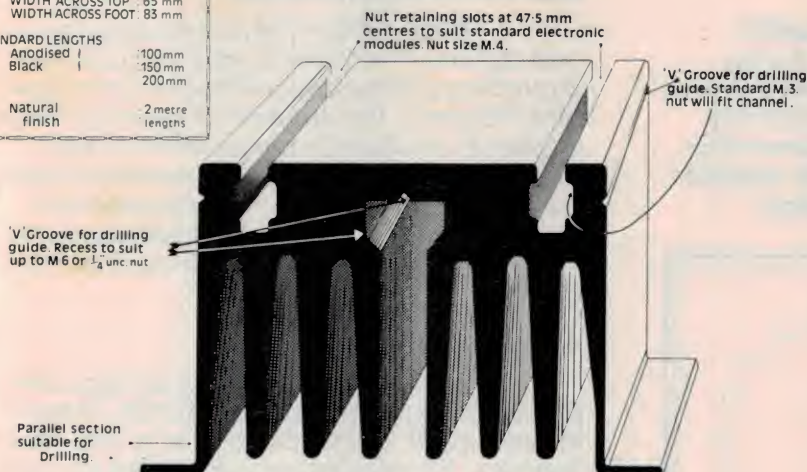
*A series of expandable extrusions in aluminium suitable for making bench top instruments & domestic products.*

*The design of this system facilitates a simple plug-together circuit construction eliminating much assembly detail, & the need for many screws.*

*For further details, ask for Packaging Leaflet.*

**MADE IN AUSTRALIA**

DIMENSIONS	
HEIGHT	50 mm
WIDTH ACROSS TOP	65 mm
WIDTH ACROSS FOOT	83 mm
STANDARD LENGTHS	
Anodised	100mm
Black	150mm
	200mm
Natural finish	2 metre lengths



*Versatility is the keynote of this extrusion. The incorporated features permit high-speed assembly with minimum use of jigs & fixtures for fitting electronic "pack" & stud mount devices, as well as terminals*

### Performance

*100mm Black Anodised length-  
Vertical in free air.*

*1.4° C/W @ 30W*

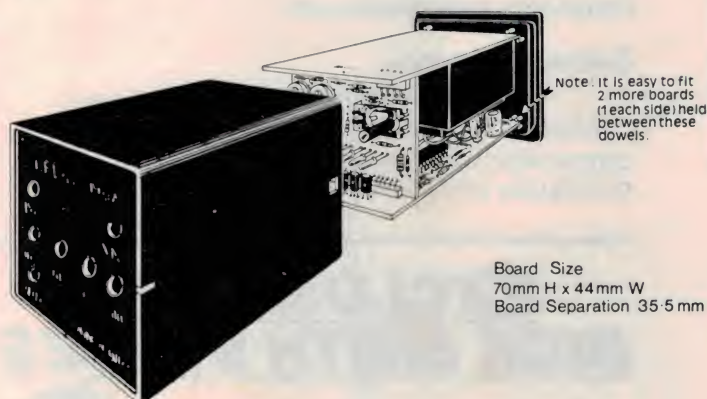
*Don't forget - this extrusion is compatible with*

*Series II Extrusions -*

*SEE ABOVE ILLUSTRATION*

## HEATSINK EXTRUSION TYPE 150/1-5

**MADE IN AUSTRALIA**



TYPICAL APPLICATION SHOWING HIGH DENSITY PACKAGING AND VERSATILITY OF THE UNIQUE BASE.

*An upgraded variation of a popular standard*

### FEATURES-

*Polycarbonate Box  
Glass reinforced Nylon base with Tin Plated pins  
8 and 11 pin format  
Improved Flat Top label Recess  
Easier assembly  
Low cost  
Impact Resistant*

## 4a SERIES ENCLOSURE MADE IN AUSTRALIA

**134A AYR ST. DONCASTER VIC. 3108 TEL: (03) 850 6884**



# \$495<sup>00</sup>

## THAT'S ALL YOU PAY FOR THIS REVOLUTIONARY PRINTER ...

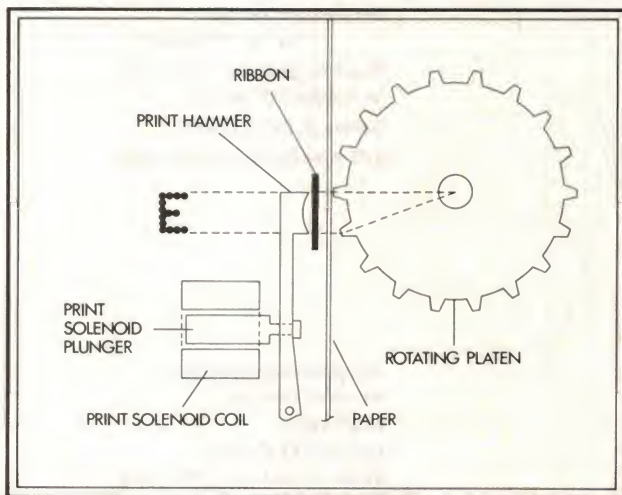
Cat. No. X-3252 P & P \$5.50

### The Uni-Hammer Replaces Seven . . . or More.

Revolutionary? We don't know what else to call it. An impact printer with a single rugged hammer, rather than the seven or more individual solenoids and print wires found in conventional dot matrix printers.

At an incredible unit price of \$495!

Because of the unique Uni-Hammer design, the X-3252 is smaller and simpler than other dot matrix printers yet costs considerably less. Which makes it a natural for the personal or small business user who wants a quality, reliable impact printer at the lowest possible price.



### A Product of the Seiko Group

It took a company such as the Seiko group, world's largest watch manufacturer, with vast experience in the design of small, intricate, precision products, to come up with a totally new concept in dot matrix printing.

#### Fan Form Paper

2,000 sheets continuous fan form paper to suit printer

Cat. X-3254 **\$27.50**

#### Replacement Ribbons

Cat. X-3253 **\$8.95**



### How the Uni-Hammer Works

The X-3252, which prints both graphics and alphanumerics, uses a rotating platen with protruding splines positioned behind the paper (see diagram). The character or graphics image is created by multiple hammer strikes in rapid succession as the print head advances across the paper. The precision gear train assures exact positioning of the print hammer relative to the splines on the platen, to provide excellent print quality.

### A Complete Printer

The X-3252 has features comparable to printers selling for thousands of dollars. These include upper / lower ASCII character sets, ribbon cartridge, 80 columns at 12 characters per inch, adjustable tractor feed, original and 2 copies, 30 characters per second, and full graphics with a resolution of better than 60 dots per inch in both horizontal and vertical axes.

### Centronics Interface

The X-3252 DOT MATRIX PRINTER has a Centronics-type parallel data interface and is compatible with System 80, TRS-80, Sorcerer and Apple computers etc.

## EXCLUSIVE TO DICK SMITH STORES

SEE OUR OTHER ADVERTS  
FOR STORE ADDRESSES.  
Available by mail order  
(P. & P. \$5.50 from  
P.O. Box 321, North Ryde)





# GRAPHIC DETAILS

MANY CURRENTLY available personal microcomputers are equipped with memory-mapped screens and graphics character sets. These facilities allow the user to produce pictorial and graphic displays (the resolution generally being somewhat crude) and play all those interesting games. But what if you want to translate a program written for another machine which uses another graphics set and has a different screen memory area? Up till now this has been a difficult task, and its success has tended to depend on the quality of the documentation supplied with the published software.

Now, if you had a series of charts showing all the standard codes and screen positions, you could look up on the appropriate one, cross-reference to your machine and select the correct graphic and its code. Here we give a selection of graphics sets belonging to some of the popular machines, along with a variety of useful notes. But before we dive in, it is necessary to explain where they all came from.

## The ASCII set

The standard character code set for computers is known as ASCII, the acronym for American Standard Code for Information Interchange. It is based around a seven-bit natural binary sequence, thus providing a total of 127 different alphanumeric and control codes. Although  $2^8 = 128$  we usually regard 'all zeros' and 'all ones' as NULL codes, hence the figure of 127 unique codes. In many systems an eight-bit code is used, with the extra bit functioning as a parity check.

The first table gives the complete ASCII character set, but it is important to bear in mind that this and all the subsequent tables are printed as they would be written on paper (black on white), whereas the VDU displays everything in white on black, so you must mentally reverse everything in order to 'see' what it looks like on the screen.

The ASCII codes from 1 to 32 have special control functions. The ones of most use to the general programmer are as follows: 7 — Bell, 10 — Line feed, 12 — Form feed (can be used as a Clear Screen), 13 — Carriage return, 32 — Space. On some machines, notably those of US origin, code 35 will be a # (hash) symbol.

## Character codes

All the alphanographic code sets are similar in a number of ways to the ASCII set in that their alphanumeric codes follow the same sort of pattern, code E being a number four greater than code A, for example. In general the first 31 codes are used for graphics, as are the extra 127 codes not used by the ASCII set. It should be noted at this point that these numbers are not replacements for the ASCII code but numbers to be used in conjunction with the BASIC PEEK and POKE commands, which access a referenced location in memory.

If you wish to use the ASCII set then the BASIC function CHR\$( ) should be used; for example, PRINT CHR\$(12) clears the screen by using the appropriate ASCII control

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0	NUL	32	SP	64	@	96	
1	SOH	33	!	65	A	97	a
2	STX	34	!!	66	B	98	b
3	EXT	35	£	67	C	99	c
4	EOT	36	\$	68	D	100	d
5	ENQ	37	%	69	E	101	e
6	ACK	38	&	70	F	102	f
7	BEL	39	!	71	G	103	g
8	BS	40	(	72	H	104	h
9	HT	41	)	73	I	105	i
10	LF	42	*	74	J	106	j
11	VT	43	+	75	K	107	k
12	FF	44	,	76	L	108	l
13	CR	45	—	77	M	109	m
14	SO	46	▪	78	N	110	n
15	SI	47	/	79	O	111	o
16	DLE	48	0	80	P	112	p
17	DC1	49	1	81	Q	113	q
18	DC2	50	2	82	R	114	r
19	DC3	51	3	83	S	115	s
20	DC4	52	4	84	T	116	t
21	NAK	53	5	85	U	117	u
22	SYN	54	6	86	V	118	v
23	ETB	55	7	87	W	119	w
24	CAN	56	8	88	X	120	x
25	EM	57	9	89	Y	121	y
26	SUB	58	:	90	Z	122	z
27	ESC	59	;	91	[	123	{
28	FS	60	<	92	\	124	!
29	GS	61	=	93	]	125	}
30	RS	62	>	94	↑	126	~
31	US	63	?	95	←	127	DEL

The ASCII code set. Codes 0 to 31 are non-printing and are used to control external devices.

code, whereas POKEing code 12 would output the respective graphic character. This apparent quirk is a trap for the unwary, but a little practice soon prevents the silly mistakes.



## Standard codes

One of the commonly asked questions is: "how can we give the cursor movements?" The answer is simple: you use the standard set of character codes we have developed. These are as shown in Table 1.

To indicate that these are not part of the computer program we always enclose them in square brackets; most systems will generate a Syntax Error if you try to run a program without converting them into something more sensible. This idea has been expanded to include graphics as well, simply because many people don't possess printers that can draw them.

To indicate the appropriate graphics character for a machine such as the Commodore, the following procedure is used. Each key is fitted with a graphic legend that corresponds to the graphic that will be produced when that key is pressed in the 'graphics' mode. The 'heart' symbol, for example, is on the 'S' key. To indicate that you want the heart you write it as [↑S].

With both the graphics and the cursor codes you can indicate multiple entries by inserting a number; [12 CD] would mean 'twelve Cursor Downs'. If you wish to clarify the graphics by means of a REM statement do make it clear which lines you are referring to; an even better method is to use a short table at the beginning of the program, or as part of the description.

[CD]	Cursor Down
[CU]	Cursor Up
[CL]	Cursor Left
[CR]	Cursor Right
[CLS]	Clear Screen
[HOM]	Home Cursor
[REV]	Reverse Graphics On
[OFF]	Reverse Graphics Off
[SPC]	Space Character

Table 1. The way in which we represent the various cursor controls and screen function commands.

## Footnote

These tables are all compiled with the help of the computer manufacturers' data, but some companies seem to be very slow in submitting the information. If you own a machine that has not been featured and you think that it should be then please contact us with the details.

□ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ □ □ ■ □ □ ■ ■ ■  
 □ □ □ □ □ □ □ □ ■ □ ■ □ ■ □ ■ □ □ ■ □ □ ■ □ □ ■ ■ ■ ■ ■ ■ ■ ■  
 □  
 [P0] [P1] [P2] [P3] [P4] [P5] [P6] [P7] [P8] [P9] [P10] [P11] [P12] [P13] [P14] [P15]

□ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ □ □ ■ □ □ ■ ■ ■  
 □ □ □ □ □ □ □ □ ■ □ ■ □ ■ □ ■ □ □ ■ □ □ ■ □ □ ■ ■ ■ ■ ■ ■ ■ ■  
 ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □  
 [P16] [P17] [P18] [P19] [P20] [P21] [P22] [P23] [P24] [P25] [P26] [P27] [P28] [P29] [P30] [P31]

□ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ □ □ ■ □ □ ■ ■ ■  
 □ □ □ □ □ □ □ □ ■ □ ■ □ ■ □ ■ □ □ ■ □ □ ■ □ □ ■ ■ ■ ■ ■ ■ ■ ■  
 □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■ □ ■  
 [P32] [P33] [P34] [P35] [P36] [P37] [P38] [P39] [P40] [P41] [P42] [P43] [P44] [P45] [P46] [P47]

□ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ ■ □ □ ■ □ □ ■ ■ □ □ ■ □ □ ■ ■ ■  
 □ □ □ □ □ □ □ □ ■ □ ■ □ ■ □ ■ □ □ ■ □ □ ■ □ □ ■ ■ ■ ■ ■ ■ ■ ■  
 ■  
 [P48] [P49] [P50] [P51] [P52] [P53] [P54] [P55] [P56] [P57] [P58] [P59] [P60] [P61] [P62] [P63]

## Pixel Codes

The above codes are generated within each character space as 'chunky' graphics. We have given them each a 'standard' code for future use.



# GRAPHIC DETAILS

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0	@	32	SP	64		96	SP	128	@	160	SP	192		224	SP
1	A	33	!	65		97		129	A	161	!	193		225	
2	B	34	"	66		98		130	B	162	"	194		226	
3	C	35	#	67		99		131	C	163	#	195		227	
4	D	36	\$	68		100		132	D	164	\$	196		228	
5	E	37	%	69		101		133	E	165	%	197		229	
6	F	38	&	70		102		134	F	166	&	198		230	
7	G	39	'	71		103		135	G	167	'	199		231	
8	H	40	(	72		104		136	H	168	(	200		232	
9	I	41	)	73		105		137	I	169	)	201		233	
10	J	42	*	74		106		138	J	170	*	202		234	
11	K	43	+	75		107		139	K	171	+	203		235	
12	L	44	,	76		108		140	L	172	,	204		236	
13	M	45	-	77		109		141	M	173	-	205		237	
14	N	46	.	78		110		142	N	174	.	206		238	
15	O	47	/	79		111		143	O	175	/	207		239	
16	P	48	0	80		112		144	P	176	0	208		240	
17	Q	49	1	81		113		145	Q	177	1	209		241	
18	R	50	2	82		114		146	R	178	2	210		242	
19	S	51	3	83		115		147	S	179	3	211		243	
20	T	52	4	84		116		148	T	180	4	212		244	
21	U	53	5	85		117		149	U	181	5	213		245	
22	V	54	6	86		118		150	V	182	6	214		246	
23	W	55	7	87		119		151	W	183	7	215		247	
24	X	56	8	88		120		152	X	184	8	216		248	
25	Y	57	9	89		121		153	Y	185	9	217		249	
26	Z	58	:	90		122		154	Z	186	:	218		250	
27	[	59	;	91		123		155	[	187	;	219		251	
28	\	60	<	92		124		156	\	188	<	220		252	
29	]	61	=	93		125		157	]	189	=	221		253	
30	↑	62	>	94		126		158	↑	190	>	222		254	
31	←	63	?	95		127		159	←	191	?	223		255	

Screen Memory: 32768-33767

8000H-83E7H

Format: 25 lines of 40 characters

**Notes:** Graphics characters may be converted to lower case alphabets with POKE 59468,14 and back with POKE 59468,12. CHR\$(147) clears the screen. Note that when outputting screen-based information the PET uses an absolute TAB rather than spaces, which can disrupt apparently neat formats.

## Commodore PET



# GRAPHIC DETAILS

CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL	CODE	SYM-BOL
0		32	SP	64	@	96		128		160		192		224	
1		33	!	65	A	97		129		161		193		225	
2		34	!!	66	B	98		130		162		194		226	
3		35	#	67	C	99		131		163		195		227	
4		36	\$	68	D	100		132		164		196		228	
5		37	%	69	E	101		133		165		197		229	
6		38	&	70	F	102		134		166		198		230	
7		39	'	71	G	103		135		167		199		231	
8	BS	40	(	72	H	104		136		168		200		232	
9		41	)	73	I	105		137		169		201		233	
10	LF	42	*	74	J	106		138		170		202		234	
11	FF	43	+	75	K	107		139		171		203		235	
12	FF	44	,	76	L	108		140		172		204		236	
13	CR	45	-	77	M	109		141		173		205		237	
14	CURON	46	•	78	N	110		142		174		206		238	
15	CUROF	47	/	79	O	111		143		175		207		239	
16		48	0	80	P	112		144		176		208		240	
17		49	1	81	Q	113		145		177		209		241	
18		50	2	82	R	114		146		178		210		242	
19		51	3	83	S	115		147		179		211		243	
20		52	4	84	T	116		148		180		212		244	
21		53	5	85	U	117		149		181		213		245	
22		54	6	86	V	118		150		182		214		246	
23	32/64	55	7	87	W	119		151		183		215		247	
24	[CL]	56	8	88	X	120		152		184		216		248	
25	[CR]	57	9	89	Y	121		153		185		217		249	
26	[CD]	58	:	90	Z	122		154		186		218		250	
27	[CU]	59	;	91	↑	123		155		187		219		251	
28	[HOM]	60	<	92	↓	124		156		188		220		252	
29		61	=	93	←	125		157		189		221		253	
30	ERL	62	>	94	→	126		158		190		222		254	
31	ERF	63	?	95	—	127		159		191		223		255	

## Tandy TRS-80 Model 1

Screen Memory: 15360-16383  
3C00H-3FFFH

Format: 16 lines of 64 characters, selectable to 32 characters.

Notes: Character codes from 0 to 31 are control codes. Notable ones are: 14 — Cursor on, 15 — Cursor off, 23-32/64 — character select, 29 — Reset cursor to start of line, 30 — Erase to end of line, 31 — Erase to end of frame. Pixel graphics are accessed by codes 129 to 191 inclusive and the remaining 64 are used as TAB generators from 0 spaces to 63 spaces for space commission in programs.



# Tandy's TRS-80 Color Computer Adds Color And Sound To Personal Computing!

**NEW** to Australia! Tandy Electronics introduces the TRS-80 Color Computer.

Set to add a new and exciting dimension to the world of personal computing, the addition of colour and sound will make programmes come alive as you and your family enter a new era of the computer revolution.

Tandy's TRS-80 Color Computer is complemented by an extensive range of ready-to-run software; business, personal management, educational, and entertainment programmes that will involve every member of the family.



**NOW** available for immediate delivery, the TRS-80 4K Color Computer (expandable up to 32K) starts from a low \$599\*. 269-3001

**Tandy**  
ELECTRONICS

"THE BIGGEST NAME IN LITTLE COMPUTERS"

Available through Tandy Computer Centres, Computer Departments, and participating Tandy Dealers. \*Monitor (not included)



# There's more to being a burn up at the



For those officers who really want to fly high, there is also a science degree.

At the RAAF Academy you get your Degree through the University of Melbourne and we pay you quite handsomely for the privilege.

But when you graduate as an officer you will have more than a Bachelor of Science. You will also have your pilot's wings and a job waiting for you.

By the time you're 23 the RAAF will have given you an incomparable foundation upon which to build a fulfilling career.

## GIVE YOUR CAREER A FLYING START.

With a degree from the RAAF Academy, your career will certainly have a flying start.

However, it takes more than simply a good education to fly a plane. When the F18 breathes fire it could be travelling at up to Mach 1.8 — nearly twice the speed of sound. At speeds like that you can't afford to have your head, as it were, in the clouds. You have to be alert. You have to be able to make split second decisions. And you have to know the aircraft backwards.

That not only takes training. It takes the right mind, and the right temperament. So, if you want to dream, cut out the plane. But if you want to fly, cut out the coupon. Or ring any RAAF Careers Adviser.

So long as you are an Australian Citizen, under 20 on January 1st of your year of entry,



# g a pilot than having Speed of sound.



and so long as you're matriculating this year or have already matriculated and meet our selection requirements you're eligible for entry.

*However, if you matriculate next year you could be eligible for a scholarship to help you through. Just tick the appropriate box.*

MELBOURNE	(03) 61 3731
SYDNEY	(02) 212 1011
CANBERRA	(062) 82 2333
PERTH	(09) 325 6222
ADELAIDE	(08) 212 1455
HOBART	(002) 34 7077
BRISBANE	(07) 226 2626

The RAAF Academy, Pt. Cook. It's the one place where you will literally give your career a flying start.



Application forms are available now.  
Send to: Air Force Careers Office,  
GPO Box XYZ, in your State  
Capital

I would like more information on:

- ☐ The RAAF Academy, Point Cook
- ☐ The RAAF Academy Scholarship

Name .....

Address .....

..... Postcode .....

Birthdate .....

## Air Force Officer.

Authorised by the Director General of Recruiting, Department of Defence

AFA7-DPS:111



# How to store more data on cassette

If you don't want, or cannot afford, to go to a disk-based system, then you'll certainly need to make more efficient use of your cassette storage system. Here are some very useful routines for those running something akin to 12K Microsoft BASIC.

Ian Sinclair

MOST ARTICLES and books seem to treat the subject of cassette data files very casually, assuming that any serious users must be into disk operations anyhow. This isn't necessarily the case, and this article aims to look at the neglected subject of making the best possible use of cassettes for data filing, particularly where large amounts of data are concerned.

The system on which these routines have been developed is a TRS-80, but it is more than likely that your cassette system is structured in the same way, particularly if your BASIC is the 12K Microsoft type.

## The system constraints

The fundamental data storage command is PRINT#-1, followed by the appropriate variable name, which may be numeric or string in type. Each time the PRINT#-1 command is encountered in a program the cassette motor is started, a leader of 255 bytes of synchronisation pulses recorded, then the data, checksum and filename followed by a trailer of one byte. Even if the data consists of just one number the same procedure is followed and if the PRINT#-1 command is placed in a loop the result will be a number of separate recordings equal to the number of loops performed.

Life would be considerably easier if we could write:

```
PRINT # - 1, FOR Z = 1 TO 20; L$(Z): NEXT
```

but we can't, even if 20 of the strings would fit comfortably in the 248 bytes (or so) that are allowed in each burst of recording.

## Ways round

For these reasons alone it is worth spending some time looking for alternatives to this method, both for packing and unpacking data from tape.

The simplest packing routine depends on the use of multiple variables after the PRINT#-1 command. If we write:

```
450 PRINT # - 1, L$(1), L$(2), L$(3),  
L$(4), L$(5)
```

then all five strings will be recorded in the one burst provided their length does not exceed the 248 byte limit.

This is quite adequate provided you know the length of the strings and can be sure that they will not exceed the limit. Variables can, of course, be mixed but when you recover them from the tape with the INPUT#-1 command you must ensure that the type order is maintained or errors will occur.

The problems start to arise when a large quantity of data has to be recorded and subsequently recovered, because the simple method given above does not always represent the most efficient way of going about the task. Life is easy if the data comes in a standard form; take strings of 12 characters in length, for example. If these were arranged as an array, L\$(n), and each element contained a string of 12 characters we could pack 20 of them into one burst of recording:

```
100 T$ = '': FOR J = 1 TO n STEP  
20: FOR Z = 0 TO 19  
110 T$ = T$ + L$ (J + Z): NEXT  
Z: PRINT # - 1, T$: T$ = '': NEXT J
```

The total number of variable items is represented by n in the above example. Using this technique you can pack five minutes of tape with a very impressive number of bytes of information, five seconds per 240 byte burst giving a total of 2880 bytes per minute or 14K in five minutes.

To actually unscramble all this information the subroutine given in Listing 1 is needed. This replays the tape using the INPUT#-1 command and uses the MID\$ string operator to separate out the 12 character groups from the complete string. There are several ways of terminating the playback which avoid the normal error message that results from reading nothing.

The first is to actually PRINT#-1, n in line 480 so that the routine knows how many sets of characters it is supposed to read. An alternative is to detect a null string and use that as the terminator, as has been done in Listing 1. The third method is to use the built-in error trapping routines of the TRS-80 to force the program out of the INPUT loop when an 'out of data' error occurs.

## How long . . . ?

The really thorny problem, however, is when strings of undetermined length have to be recorded and replayed. Data such as names and addresses won't always conform to a convenient 12 characters per string format, yet we already know how wasteful it is to use one variable at a time. There are three possible solutions to this problem, all of which I use on a regular basis.

The first is to pad out all the data to a standard length. As long as the data does not vary too widely this is a reason-



ably acceptable technique, and Listing 2 gives a routine which will pad to a length of 20 given that the data is between 8 and 20 characters in length. Normally, we would not pad strings which vary quite so much; between 12 and 20 would be more acceptable.

One of the failures of this technique is that it generally results in ragged printing, so some de-padding will have to be performed before the data can be sent to a printer. This can be performed by a routine such as that shown in Listing 3; it's slow, but so are printers! When you are faced with strings that can vary between 1 and 50 characters in length, padding is no longer a viable solution and another method of packing must be sought.

## Spaces that aren't

One of the alternatives which can be usefully employed is code 128. On the TRS-80 this produces a space, but it is not identical to the ASCII 32 space that the keyboard produces. This character is often available and a look through the graphics set of your system should reveal one. As shown in Listing 4, this character can be identified as a separate entity and is used as a delimiter between strings.

In order to check that the string you're about to add onto the block will not cause the total number of bytes to exceed the set maximum of 240, we must incorporate the look-ahead routine in line 570. As long as the length does not exceed 240 we continue packing; if it would exceed on adding the next string we stop, record the block of data, zero the byte count and start again.

The packing speed is fairly fast but the corresponding unpacker, Listing 5, is not, owing to the fact that each character in turn has to be inspected to see if it is CHR\$(128). If the data is being printed as it is being unpacked then this delay is of less importance.

## The ultimate packer?

My 'best' solution to the problem is to use a slightly lower packing density, which increases the recovery speed. The packing routine in Listing 6 finds the total length of each string with the LEN() function and then packs the data string with the string and its length. For machines which have the VARPTR function, like the TRS-80, the use of PEEK (VARPTR(L\$(n))) provides the

same information as the LEN() function. The data string will now look something like:

```
15S.R.SMITH 1042719P.J.ROBERTSON
512069C.O.JONES etc...
```

Note that the single figure values of length have been padded out to two places by using RIGHT\$ ("00"+STR\$(L),3). As before, the total string length is monitored before concatenation to ensure that the target of 240 bytes is not exceeded.

Recovering the data from this kind of packing is performed by a routine like that of Listing 7. The first two characters of the string give the length of the first sub-string in the block and from this the starting point of the next string length can be found. Both the packing and unpacking routines are quite fast, even on a standard machine; adding the speed-up package and Southern Software's ACCEL program will make them very fast indeed.

It is worth noting, however, one point which seldom seems to be made in print, which is that the speed of any string handling routine varies according to the number of strings used. Each time a string is declared, even if it is being nulled, a new string space is prepared and the computer has to reorganise its variable storage area. When the reserv-

ed string space is very small the delays caused by this memory management routine, or garbage collection as it is often called, can be very large. On a recent test a recording of 300 strings took nearly two hours simply because of the time taken by the management routine.

The only way out of this predicament is to make sure that the memory areas used are not too full. This can be done by recording a set number of strings and then re-running the program or simply by CLEARing the variable areas. Pauses caused by the management routines can be easily detected; they don't respond to the Break key!

## In conclusion

If you are not yet disk-based then you can at least take heart, there's still some life left in the old data cassette yet. Indeed, bulk storage is much better handled by tape than disk, especially long lists that are simply processed sequentially. The floppy disk also has rivals in devices such as the Stringy Floppy.

Obviously the speed and efficiency of all these routines is limited by the operating speed of the computer and the storage speed of the cassette system. If time is critical one can always revert to machine code routines for the packing and unpacking of the data. ●

```
490 P=0
500 INPUT#-1,TS:IF TS="" THEN 560
510 FOR J=1 TO 20
520 LS(P)=MID$(TS,12*N-11,12)
530 P=P+1
540 NEXT J
550 GOTO 500
560 REM "REMAINING PROGRAM"
```

Listing 1. The simplest 'unpacker' using strings of standard length.

```
100 TS=""
110 FOR K=1 TO N STEP 12
120 FOR J=0 TO 11
130 LS=RIGHT$(STRINGS(12,32)+LS(K+J),20)
140 TS=TS+LS
150 NEXT J
160 PRINT#-1,TS
170 TS=""
180 NEXT K
```

Listing 2. A routine to create strings of a fixed length and pack them onto the tape.

```
100 FOR H=1 TO LEN(L$(N))
110 IF ASC(MID$(L$(N),H,1))=32 THEN NEXT
ELSE LPRINT TAB(10) RIGHT$(L$(N),
LEN(L$(N)))-4)
```

Listing 3. The output from the 'unpacker' will need to be formatted before printing or display.

```
500 CLS:PRINT "PREPARE A CASSETTE OF
SUITABLE LENGTH FOR A DATA FILE"
510 PRINT "NOTE THE START POINT ON THE
COUNTER, PRESS PLAY AND RECORD"
PRINT "PRESS ENTER WHEN READY"
530 INPUT X:CLS:PRINT TAB(21)"PLEASE WAIT"
540 PRINT#-1,I
550 AS=" "
560 FOR N=1 TO 1:AS=AS+LS(N)+CHR$(128)
570 IF LEN(AS)+LEN(L$(N+1))<245 THEN 590
580 PRINT#-1,AS:AS=" "
590 NEXT N:PRINT#-1,AS
600 CLS:PRINT "RECORDING FINISHED. PRESS
ENTER TO RETURN TO MENU"
```

Listing 4. Using a special code to separate the items in each block.

```
620 CLS:PRINT#336,"PREPARE THE INDEX TAPE
TO REPLAY"
630 PRINT TAB(13)"PRESS PLAY KEY. WHEN
READY PRESS ENTER"
640 INPUT X:CLS:PRINT TAB(19)"ENTERING
DATA, PLEASE WAIT":X=1
650 INPUT#-1,I:REM "I IS THE MAX NUMBER
660 INPUT#-1,AS:FOR N=1 TO 245:
BS=MID$(AS,N,1)
670 IF BS<CHR$(128) THEN LS(X)=LS(X)+BS:
GOTO 690
680 X=X+1
690 NEXT N:IF X<1 THEN GOTO 660
700 CLS:PRINT TAB(26)"DATA ENTERED"
```

Listing 5. The corresponding 'unpacker' for the routine above.

```
7000 CLS:TS="":PRINT#340,"RECORDING, PLEASE
WAIT":PRINT TAB(20) STRINGS(22,95):
PRINT#-1,BS,S,R,TT
7010 FOR X=1 TO R:QS(X)=" { 2 SPC}" + QS(X):
QS(X)=RIGHT$(QS(X),3):L=LEN(L$(X))+3:
CS=RIGHT$(TS+"STR$(L),3):
TS=TS+CS+LS(X)+QS(X):IF LEN(TS)+
LEN(L$(X+1))<240 THEN NEXT
7020 PRINT#-1,TS:IF X<R THEN TS="":NEXT
7030 CLS:PRINT#329,"RECORDING COMPLETE,
PRESS ANY KEY TO CONTINUE"
```

Listing 6. This routine gives the best overall performance for general use.

```
3000 CLS:PRINT#347,"REPLAY TAPE":PRINT
TAB(27) STRINGS(11,35):PRINT:PRINT
TAB(15)"PREPARE CASSETTE AND PRESS
PLAY":PRINT TAB(15):INPUT"PLEASE
ENTER CLASS DESIGNATION":BS:N=1:
Z=1:Y=0
3010 INPUT#-1,BS,S,R,TT:IF BS<>BS THEN
FS="WRONG TAPE":GOSUB 1500:GOTO 40
3020 INPUT#-1,TS
3030 L=VAL(MID$(TS,Z,3)):LS(N)=MID$(TS,3+Z,
L-3):QS(N)=MID$(TS,Z+L,3):Z=Z+L+3:
N=N+1:IF N<R AND Z<LEN(TS) THEN GOTO
3030 ELSE IF K<R THEN TS="":Z=1:
GOTO 3020
```

Listing 7. A typical program segment for recovering data packed by the routine above.



**20% OF ALL PRICES THIS MONTH (Exp. End March '82)**  
(Applies Only To This Ad And Does Not Include Super Specials)

# ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131.

**ELECTRONIC COMPONENT SUPPLIERS, DESIGNERS & MANUFACTURERS.**  
**RITRONICS WHOLESALE (03) 489-7099. MAIL ORDERS (03) 481-1436.**

**TELEX: AA38897**

For heavier items add additional postage. Extra heavy items sent Comet freight on. Prices subject to change without notice. Send 60c and SAE for free catalogues. Minimum pack and post \$1.00. Bankcard Mail Orders welcome.

## SUPER SPECIALS

2708	\$ 4.50	Z80S10	\$21.00
2716	\$ 4.90	1771	\$19.00
2732	\$ 9.00	1791	\$59.00
6800	\$ 7.90	1795	\$59.00
6802	\$11.00	4118	\$ 1.95
6809	\$22.00	2114	\$ 2.50
8085	\$12.50	TA7205	\$ 3.30
8080	\$ 7.00	100 Red Leds	\$ 9.00
6821	\$ 3.50	BUX80	\$ 3.90
Z80P10	\$ 5.00	BU126	\$ 1.90

CMOS	74C04	.40	LF356-AN	1.10	UA4558TC	1.40	7494	.90	74LS73	.55	2N2219A	.60	AC186	.70	1P3055	1.20	MC6671	3.00
4000	74C08	.40	LF357	1.10	MM5837	2.50	7495	.45	74LS74	.60	PN2222	.20	AD149	2.50	VN88AF	2.50	4N28	.85
4001A	74C10	.40	LM358	.70	LM7555	1.80	7496	.80	74LS75	.45	PN2463	.35	AD162	1.70	MICRO CHIPS		4N33	1.20
4001B	74C14	.90	LM373	4.10	Mc10116L	.95	7497	2.50	74LS76	.50	2N2484	.65	BC318	.70	DACO 080	2.00	MM80C95	.90
4002	74C20	.40	LM374	5.40	LF13741	.60	74107	.80	74LS77	.50	2N2646	.70	BC319	.18	2012 200 NS2.00		80C96	.90
4006	74C30	.40	LM376	.70	LF13741-H	.70	74109	.60	74LS78	1.00	2N2894	1.10	BC327	.15	2102 350 NS2.00		MM80C97	.90
4007	74C32	.40	LM377	2.90	DS75452	.60	74116	2.20	74LS83	.50	2N2904	.45	BC328	.30	2102 450 NS1.40		8098	.90
4008	74C42	1.10	LM379	5.70	76477	4.90	74121	.45	74LS86	.50	2N2904	.45	BC337	.30	2102 650 NS1.40		OPTOCOUPERS	
4009	74C48	1.55	LM380 8PIN	1.30	75451	.60	74122	.65	74LS90	.70	2N2905	.40	BC338	.30	2111	8.60	MCT2	1.00
4010	74C73	.75	LM380		75491	1.40	74123	.60	74LS92	.90	2N2906	.45	BC547	.15	2114 150		MCT6	3.30
4011	74C74	.70	14PIN	1.50	75492	1.40	74125	.55	74LS93	.80	2N2913	1.20	BC548	.15	NS	11.15	MC275	1.50
4012	74C76	.75	LM318A-N	2.40	TTL (s)		74126	.60	74LS95	1.55	PN2907	.30	BC549	.15	2114 300 NS3.90		MCC671	3.00
4013	74C83	1.40	LM318N	1.80	74S00	.80	74132	.80	74LS96	.65	PN2907	.30	BC549C	.40	2114 450 NS3.50		4N28	1.00
4014	74C85	1.20	LM382N	2.00	74S02	.80	74141	1.10	74LS107	.60	PN3054	.90	BC557	.16	8-31	3.30	4N33	1.20
4015	74C86	.80	LM383	2.70	74S04	.80	74145	.85	74LS109	.60	PN3055	.90	BC558	.16	32 up	3.30	4N36	1.00
4016	74C90	.80	LM384	2.40	74S10	.75	74147	2.00	74LS112	.65	PN3301	.40	BC559	.16	2513	14.50	VOLTAGE	
4017	74C93	1.40	LM386	1.00	74S11	.75	74148	1.40	74LS113	.65	PN3440	1.10	BC637	.25	2516	55.00	REGULATORS	
4018	74C95	.95	LM387	1.30	74S32	.75	74150	1.20	74LS114	.50	PN3502	.70	BC638	.36	2532	69.00	78L05	.40
4019	74C107	.70	LM391	1.80	75S51	.75	74151	.60	74LS122	.50	PN3503	.70	BC639	.90	2650	23.00	LM341P-5	.80
4020	74C150	3.40	LM393	.80	74S74	1.20	74152	4.90	74LS125	.75	PN3563	.30	BC640	.90	2708	8.50	7805	1.00
4021	74C151	1.00	LF398	5.00	74S86	1.40	74153	1.20	74LS126	.70	PN3564	.30	BCY70	.85	4116	5.50	LM309K	1.20
4022	74C160	.90	8038	6.00	74S112	1.20	74154	1.20	74LS132	.80	PN3565	.30	BCY71	.85	5101	9.00	7805K	2.10
4023	74C192	.70	NE530	1.10	74S135	2.20	74155	.90	74LS133	.50	PN3566	.30	BD135	.70	MM5204	12.50	LM323-K	6.90
4024	74C164	1.10	OM350	9.90	74S138	3.20	8728	1.60	74LS136	.50	PN3567	.30	BD136	.70	MM5220	7.20	7805KC	8.50
4025	74C173	1.00	555	.40	74S157	2.95	9310	.65	74LS138	1.20	PN3568	.30	BD137	.70	MM5307	18.00	LM341P-8	.80
4026	74C174	.80	556	1.10	74S158	2.95	9311	1.00	74LS139	.65	PN3638	.30	BD138	.70	MM5309	6.50	78L12CP	.40
4027	74C175	1.00	LM565	1.30	74S182	3.30	9312	1.35	74LS151	.75	PN3639	.30	BD139	.70	MM5312	9.00	79L12C	.65
4028	74C192	1.20	LM565CH	2.00	7400 SERIES		74156	1.50	74LS153	.60	PN3640	.30	BD140	.70	MM5369	2.60	LM341P12	.75
4029	74C195	1.00	NE566	2.50	7400	.40	74157	.60	74LS154	1.50	PN3641	.30	BD235	.65	5387	8.50	7812	1.00
4030	74C221	1.90	LM567	1.50	7401	.40	74161	1.00	74LS155	1.00	PN3642	.30	BD236	.65	5502	10.50	7912K	2.15
4031	74C373	1.80	NE571	6.50	7402	.40	74162	1.00	74LS156	1.00	PN3643	.30	BD262	1.20	6508	5.50	7912KC	2.60
4034	74C374	2.00	LM709 14PIN	.70	7403	.40	74163	.85	74LS157	.90	PN3644	.30	BD301	.75	6520	5.50	79H12KC	8.00
4035	74C901	.90	UA710CA	.60	7404	.40	74164	.60	74LS158	.70	PN3644	.30	BD302	.75	6522	10.00	78L15	.35
4039	74C902	.90	LM710-CH	.90	7405	.50	74165	.60	74LS160	.85	PN3692	.50	BD263	1.25	6523	17.00	79L15	.65
4040	74C905	11.20	711	.80	7406	.50	74174	.50	74LS161	.85	PN3693	.35	BD435	.75	6551	17.00	LM341P15	.80
4041	74C906	.90	UA711-H	.85	7407	.50	74175	.90	74LS162	1.00	PN3702	.30	BD646	1.70	MC6900P	9.00	7815	1.00
4042	74C907	.80	UA716HC	6.25	7408	.40	74176	1.10	74LS163	.85	PN3694	.30	BD647	1.80	MC6802	13.00	7915CT	1.80
4043	74C915	1.50	723	.50	7409	.40	74177	1.10	74LS164	1.30	PN3704	.30	BD675	.80	MC6808	12.50	7915KC	2.60
4044	74C922	3.80	LM723CH	1.10	7410	.40	74180	.90	74LS165	.50	PN3709	.30	BDV648	4.50	6810A	4.90	78H15KC	6.50
4046	74C923	5.00	LM725	3.90	7411	.40	74181	2.30	74LS168	1.90	PN3713	2.20	BDV658	4.50	6820	5.50	78L18	.35
4047	74C925	7.80	LM733	1.20	7412	.40	74182	.90	74LS169	1.90	PN3819	.80	BF115	.50	6821	6.00	7818	1.40
4048	74C926	7.80	UA739	2.00	7413	.50	74184	1.20	74LS170	2.80	PN3866	2.00	BF173	.70	6850	5.15	78L24	.35
4049	74C927	5.90	741	.25	7414	.70	74185	1.20	74LS173	.90	PN3904	.30	BF180	.70	6852	6.40	79L24	.65
4050	74C932	5.50	LM741-H	1.20	7416	.50	74190	1.00	74LS174	.90	PN3906	.30	BF195	.30	7106	12.60	7824	1.10
4051	80C SERIES		UA747	1.00	7417	.60	74191	1.50	74LS175	.90	PN4030	1.10	BF198	.30	7107	15.00	LM371T	2.40
4052	MM80C95	.90	UA747HC	2.20	7420	.40	74192	1.70	74LS181	2.50	PN4032	.55	BF199	.30	7210	13.20	LM337T	3.80
4053	80C96	.90	UA748	.50	7421	.40	74193	.80	74LS189	3.80	PN4033	.90	BF336	.80	Z80 CPU	14.00	LM317K	4.50
4060	MM80297	.90	UA748HC	1.25	7423	.50	74194	1.10	74LS190	1.30	PN4036	1.00	BF337	.80	Z80A CPU	16.00	LM337K	5.90
4066	80C98	.90	UA753	1.80	7425	.45	74195	.65	74LS191	1.10	PN4037	.90	BF458	.90	Z80 P10	13.80	LM350K	8.40
4068	LINEAR		UA760HC	4.10	7426	.40	74196	.85	74LS192	.85	PN4121	.30	BF494	.30	Z80A CTC	16.50	78HGK	10.50
4069	LMH002	9.50	UA777	2.40	7427	.40	74197	.70	74LS193	.85	PN4233	1.60	BFX85	.75	Z80 P10	13.80	BRIDGES	
4070	LMH002CD	16.50	UA777HC	2.65	7430	.40	74198	1.10	74LS194	.70	PN4235	1.90	BFY50	.90	Z80A DMA	40.70	VM48	1.50
4071	LMH042CH	8.60	9334	1.70	7432	.40	74199	1.30	74LS195	.80	PN4236	2.20	BFY90	1.30	Z80 S10/0	56.90	W02	.60
4072	LMH007	12.70	UA743	1.80	7437	.40	74221	.90	74LS196	1.25	PN4249	.30	BU126	3.00	Z80 S10/1	56.90	W04	.60
4073	LMH071	12.70	UA760HC	4.10	7438	.50	74290	.90	74LS197	1.00	PN4250	.30	BUX80	7.90	Z80 S10/2	56.90	KHP02	2.60
4075	TL071	1.00	UA796HC	1.70	7440	.50	73293	.90	74LS199	1.10	PN4258	.30	BUX80	7.90	Z80A		KBP602	2.50
4076	TL072	1.50	LM802	1.10	7441	1.00	74365	.80	74LS221	1.10	PN4354	.30	TF2955	1.40	S10/0	63.00	KBP604	2.60
4077	TL082	1.50	LM1310N	2.40	7442	.50	74366	.80	74LS245	2.35	PN4355	.30	MEL12	.90	S10/1	63.00	KBP606	2.80
4078	SAK140	2.20	1408	4.90	7443	1.40	74367	1.00	74LS247	.90	PN4356	.30	BU326A	3.40	Z80A		KHP1002	2.60
4081	UAA170	3.50	LM1458	.60	7444	1.20	74368	1.00	74LS249	1.30	PN4396	5.00	MJ2955	1.00	S10/2	63.00	KBP1006	3.20
4082	UAA180	3.50	UA1488	1.50	7445	1.10	87196	1.80	74LS251	.80	PN4401	.50	MJ4032	7.40	8035	27.00	MDA3501	3.20
4089	LM301	.50	UA1489	1.50	7446	1.00	93114	1.30	74LS253	.90	PN4402	.50	MJ4032	3.40	INS8050	15.00	MDA3502	3.20
4093	LM301	.50	MC1495	7.30	7447	1.00	9368	1.75	74LS257	.65	PN4403	.50	MJ4035	6.90	INS8080	18.00	MDA3504	3.40
4510	LM304-H	1.70	MC1496L	11.40	7448	1.00	9370	2.00	74LS258	.50	PN4416	2.80	MJ4502	3.70	P8085	25.00	DISPLAYS	
4511	LM305-H	.80	LM1558	1.50	7450	.50	74LS00	.40	74LS259	2.45	PN4498	2.						



# Learning logic with the 'Fox and Hen'

This program was written as a learning aid to teach students the logical AND and OR operations, and will run on both the ZX80 and ZX81 with expanded RAM.

**M.P. Biddell**

THE PROGRAM allows a discovery learning process in which students open and close the gates of six cages, to determine whether a fox can gain access to a hen and eat it. The knowledge gained from this visual and manual experimentation is applicable to all switching circuitry and all logic problems involving AND and OR gates. It makes the learning process more interactive using the computer. In fact, it's an ideal application of a micro to assist the learning process.

## Using it

The program should be started using GOTO 90. This produces the VDU display shown in Figure 1, which represents a plan view of six cages. 'F' represents the fox and 'H' represents the hen. The letters A to G represent the gates to the cages. In response to the question 'is gate A open 1 = yes 0 = no?' the student simply presses 1 or 0 followed by

NEWLINE. Pressing 0 will block gate A with a black square, thus closing it. The student is then confronted by a similar question for gate B and so on. When all the gates have been programmed to be open or closed the computer makes the quite complex decision as to whether the fox can eat the hen or not. This is obvious visually, since if a combination of gates is open to allow the fox to wander through to the hen, he could eat it. If access to the hen is allowed, the fox (F) will be POKed into the hen's cage and the hen (H) will disappear. Pressing 'R' resets the gates.

## Learning by discovery

The student is asked to examine line 440 of the program:

```
IF A AND B AND E = 1 OR C AND F AND G = 1
OR A AND D AND G = 1 OR C AND F AND D
AND B AND E = 1 THEN GOTO 470
```

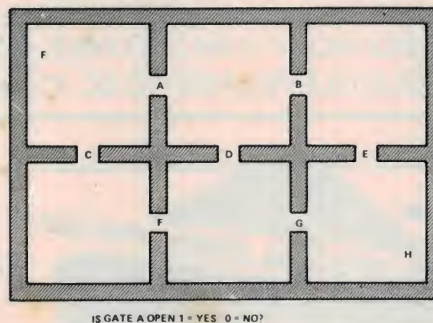


Figure 1. The screen format.

## Program Listing

```
10 FOR J=1 TO 24
20 PRINT CHR$(128);
30 NEXT J
40 RETURN
50 FOR I=0 TO 16
60 PRINT CHR$(128);
70 NEXT I
80 RETURN
90 CLS
91 PRINT "FOX AND HEN"
92 LET B=1
93 LET C=1
94 LET D=1
95 LET E=1
96 LET F=1
97 LET G=1
100 GOSUB 10
110 GOSUB 50
120 GOSUB 10
130 GOSUB 50
135 PRINT CHR$(128);
140 GOSUB 10
150 LET W=PEEK(16395)+PEEK(16397)*256
160 POKE W+82,43
170 POKE W+97,38
180 POKE W+252,43
190 POKE W+95,39
200 POKE W+260,44
210 POKE W+182,40
220 POKE W+190,41
230 POKE W+198,42
240 POKE W+264,45
241 PRINT
245 LET Z=37
246 LET Z=Z+1
247 IF Z=45 THEN GOTO 440
250 PRINT "IS GATE ";CHR$(Z); " OPEN? 1=YES 0=NO"
260 INPUT X
280 IF Z=38 THEN LET A=X
290 IF Z=39 THEN LET B=X
300 IF Z=40 THEN LET C=X
310 IF Z=41 THEN LET D=X
```

```
320 IF Z=42 THEN LET E=X
330 IF Z=43 THEN LET F=X
340 IF Z=44 THEN LET G=X
350 IF A=0 THEN POKE W+86,128
370 IF B=0 THEN POKE W+94,128
380 IF C=0 THEN POKE W+149,128
390 IF D=0 THEN POKE W+157,128
400 IF E=0 THEN POKE W+165,128
410 IF F=0 THEN POKE W+251,128
420 IF G=0 THEN POKE W+259,128
430 GOTO 246
440 IF A AND B AND E=1 OR C AND F AND G=1 OR
A AND D AND G=1 OR C AND F AND B AND E=1
THEN GOTO 470
450 PRINT "HEN IS SAFE"
460 GOTO 480
470 PRINT "FOX ATE THE HEN"
475 POKE W+82,0
476 POKE W+264,43
480 PRINT "PRESS R FOR RESET"
490 INPUT AS
500 IF AS="R" THEN GOTO 90
510 GOTO 490
```

This single line is the computer's controlling logic for this complex decision (there are many many combinations of gates). The student is asked to test as many combinations of gates as he can think of to indeed verify that this controlling logic is correct for all the combinations. Without being aware of it the user is learning, by this simulation, the basic principles of switching and logic circuitry. This is quite a fun way of learning.

## The program structure

The program overcomes the ZX80 memory mapping problem by accessing the address of the D-file through PEEKing system variables 16396 and 16397 and using these to define variable W. See line 150 of the program. The gates to the cages and the fox (F) and hen (H) are then POKed into the D-file using variable W, plus a displacement; lines 160-240 carry this out. The gates are closed by POKing CHR\$(128) into the D-file (lines 360-420).

Line 440 represents the decision-making logic for the fox to eat the hen (or otherwise). If the fox is able to eat the hen lines 475 and 476 POKE the appropriate positions to move the fox and make the hen disappear.

## The future

Programmers have concentrated, in the past, on writing games. In the educational sphere, applications have been very limited. There is a great scope for programs that simulate physical systems very closely and allow students to 'play tunes' with certain variables to see how the system would react. I believe this is the direction in which we should be progressing, since micros are very adept at quickly computing, processing large numbers of combinations and displaying the results.

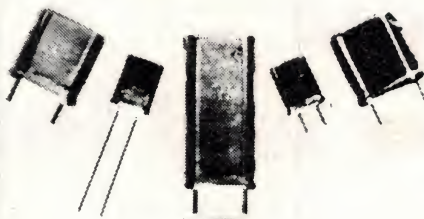
A variety of analogue and digital systems could be simulated and the student could indulge in many experiments of the type 'what happens if I?', with the micro showing the results visually.



HAPPY

36th

ANNIVERSARY



Quantity Orders of Quartz Crystals  
100 off or more available at very  
competitive prices.

Ring 546 5076 for quotes.

**Bright Star Crystals** Pty. Ltd.

PO Box 42, Springvale, Ph (03) 546-5076 Telex AA36004



COMPUTER  
CITY

**QUEENSLANDS FASTEST GROWING**

**APPLE DEALER**

**SOLE QUEENSLAND  
DISTRIBUTOR**

**THE AUSTRALIAN SOURCE**

**Introducing "THE CASIO" FX-9000P**

*The Engineers' Computer Calculator*

**THE "NEC" PC 8000 DESK TOP COMPUTER**

See us for our ever growing range

PHONE HORRIE OR RICHARD NOW FOR DETAILS (07) 398 6759, (07) 398 6571  
**COMPUTER CITY** 600 OLD CLEVELAND ROAD, CAMP HILL, 4152, BRISBANE.

**sinclair**

**ZX81**

*Personal  
computer,*

**\$250**

COMPLETE WITH  
MAINS ADAPTOR,  
LEADS & BASIC MANUAL

*Reach advanced computer comprehension in  
a few short hours with the new, mighty ZX81*

E.T.I. READERS SPECIAL \$225. FEB ONLY

16K ADD ON RAM PACK  
NOW ONLY  
**\$125**

**PROGRAM  
CASSETTES**

• PERILOUS SWAMP	(16K)	\$10.65
• DIRECTORY/RECORD TAPE & LISTING	(1K)	14.95
• REVERSI (OTHELLO)	(1K)	19.50
• SPACE TREK	(16K)	19.50
• ADVENTURE	(16K)	19.50
• 10 EXCITING PROGRAMS	(1K)	14.95
• ZX CHESS	(16K)	24.50

(B) PLUS 17% TAX

1. GAMES PACK 1	(1K)	
2. JUNIOR EDUCATION	(16K)	
3. BUSINESS & HOUSEHOLD	(16K)	\$12.18
4. GAMES PACK 2	(16K)	
5. JUNIOR EDUCATION	(1K)	
• SUPER INVASION	(1K)	19.50
• DOUBLE BREAKOUT	(1K)	19.50

**RADIO PARTS**

**MELBOURNE AUSTRALIA**  
HEAD OFFICE: 582 SPENCER ST. WEST MELBOURNE, 3003  
TELEPHONE (03) 329 7886. TELEX 32980  
SOUTHERN DEPOT: 1103 DANDENONG RD. EAST MELVERN, 3145  
TELEPHONE (03) 211 8122

☐ Z x 81 COMPUTER/S AT FEB SPECIAL PRICE

OF \$225

☐ Z x 81 16K RAM PACK AT FEB SPECIAL  
PRICE OF \$125

THE FOLLOWING PROGRAMS

TOTAL \$

ENCLOSED CHEQUE/MONEY ORDER  
OR PLEASE DEBIT

MY BANKCARD No. ....

ORDINNERS CLUB No. .... SIGNED .....

ETI FEB '82



# DICK SMITH

introduces a full featured  
**COLOUR COMPUTER**

for  
only

**\$399**

*DON'T PAY  
\$599!*

Digital cassette recorder connects here: for loading or saving programs.

Exciting range of games cartridges simply plug in!

Your colour (or B&W) TV set connects here: no need to buy an expensive colour monitor.

Add 'joystick' controls here for even more games fun.

Obtain access to data banks and other computers with a Modem: it just plugs in!



Cat X-2000

look at these  
features

look what it can  
do!

- ★ Colour graphics in up to **eight** colours – directly addressable from the keyboard!
- ★ Memory expandable up to 32K with plug-in modules.
- ★ Typewriter-style keyboard, with programmable function keys: you're really in control!
- ★ An inbuilt tone generator for music and sound effects!
- ★ It's ready to use immediately you turn it on – and it's expandable as your experience and budget require.

Yes, the VIC 20 is a truly remarkable breakthrough in computer technology – and it represents outstanding value for money. And it is fully backed with Dick Smith's own satisfaction guarantee.

Try it for yourself: if you're not completely happy you can return it within 7 days for a full refund! You can't lose!

- ★ Play a wide variety of full colour games – like space invaders, chess, etc. All you do is plug in a games cartridge!
- ★ Or write your own computer programs: with full colour display and an incredible range of graphics to choose from. Your imagination is the only limit!
- ★ Create computer music and sound effects to go with your programs! It's so easy with the VIC 20.
- ★ Give your family an introduction to the exciting world of computers: using the most exciting computer available in the world today!

come in to one of our stores and see for yourself!

**DICK SMITH**  
**Electronics**



See our other ads in this issue for store addresses

LIMITED STOCKS DUE IN  
LATE JANUARY

DSEA142



*We got off to a  
flying start with 2 pilots,  
2 mechanics and 5 planes.*



The Air Force of the 80's is a far cry from the Australian Flying Corps where it all began in 1916.

Today, without doubt, our aircraft, equipment and electronic systems reflect the technology of the future.

But one thing hasn't changed—the comradeship and dedication of our people. We're proud of that.

Security of employment, training and job satisfaction are something our members have enjoyed over the years. They're all part of the lifestyle in Today's Air Force.

The Air Force of the 80's is a young, modern, dynamic organization—young in its thinking, progressive and innovative in its action.

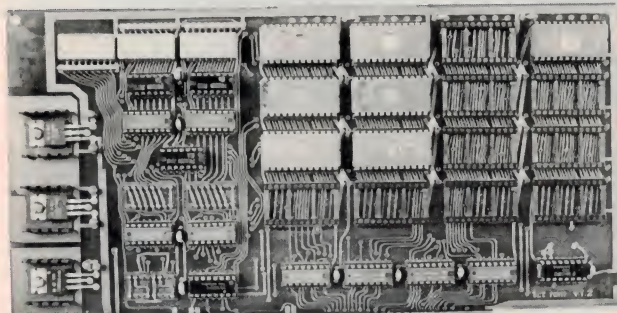
Authorised by Director General Recruiting, Dept. Defence.

*You're somebody  
in Today's  
Air Force.*





# 48k RAM FOR \$295\*



## GOODBYE STATICS

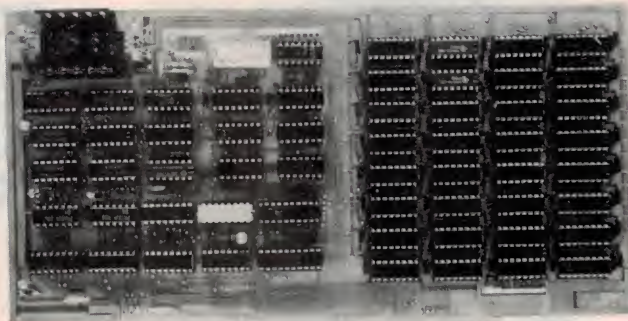
Just look at these kit prices for our 64k S100 Dynamic memory board.

	inc. tax	ex. tax
16K bytes	\$259	\$225
32K bytes	\$299	\$260
48K bytes	\$339	\$295
64K bytes	\$379	\$330
8x4116 (200ns)	\$ 40	\$ 35
Manual only	\$ 7	-

## 2716 (+5V) \$6.10\*

Yes! We sell the TCT "Universal" Prom board (ETI-682.) Take a look at these prices!

	inc. tax	ex. tax
Complete kit	\$115	\$100
Board only	\$ 69	\$ 60
2716 (+5V,450ns)	\$ 7	\$ 6.10
Manual only	\$ 7	-



### TCT Micro Design Pty. Ltd.

P.O. Box 263 Wahroonga, 2076, N.S.W.

Phone: (02) 48-5388

Please add \$3 for post and packing.

\* Plus sales tax.

## BOFFIN MAIL ORDER

### DOUBLE DENSITY FOR FERGUSON BIG BOARD

WITH SOFTWARE AND FITTING INSTRUCTIONS

### BOFFIN BUSINESS COMPUTER

Z80A, 64K RAM, 2K ROM, RS232 SERIAL PORTS, PARALLEL PORTS, 2 x 8" D/SIDED, D/DENSITY DISK DRIVES, GIVING 2.4 MEGABYTES ON LINE STORAGE, TELEVIDEO 950 TERMINAL SYSTEM, INCLUDES DESK OR MOBILE STAND AND CPM 2.2 OPERATING SYSTEM SOFTWARE:

Price: \$5,850 plus 17.5% Sales Tax.

	Less Tax	Inc. Tax	P&P
QUME 8" DOUBLE SIDED DISK DRIVES	\$582	\$684	\$25
KAGA MONITORS 18 MHz GREEN PHOS	\$223	\$262.26	\$25

### OKI:

MICROLINE 83A DOT MATRIX PRINTER 15" CARRIAGE. UPPER AND LOWER CASE WITH DESCENDERS.

Price \$1,300 plus Tax P&P \$30.

Our Prices for 5 1/4" Disc Drives are too good to advertise.

ALL TYPES OF EPROM INCLUDING CPU's PROGRAMMED.

From \$5 to \$25 depending on type.

Please write or phone for details...

## BOFFIN

MICRO-COMPUTER DESIGN AND SYSTEMS

P.O. BOX 68, THORNBURY, VIC. 3071

Please allow 21 days for delivery.



Don't Miss

# GREAT VALUE

The most desirable 6502 fruit

## THE MICRO CHERRY

with

**PAL colour card,  
48K RAM, fully assembled**

and

All for UNDER \$1,000 (Tax Ex.!)!

FROM...

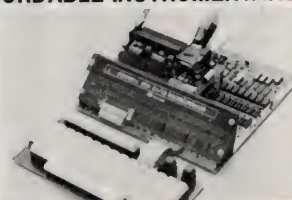
# CW

COMPUTERWARE

305 La Trobe Street,  
Melbourne, 3000

Telephone: (03) 602 1006

## AIM-65 — SYM-1 AFFORDABLE INSTRUMENTATION



### AIM 65-40 .....\$1259

- On board exp. to 65K address up to 128K
- 40 col. intelligent graphic/alpha printer
- ASC11 Keyboard.

### SPECIAL

AIM65 Assembler in ROM .....	\$35
AIM65 Microsoft BASIC in ROM .....	\$65
EPSON MX80 Type 1 .....	\$730
SYM-1 1K .....	\$190
AIM65 1K 1 to 4 .....	\$454
AIM65 5 on .....	\$419

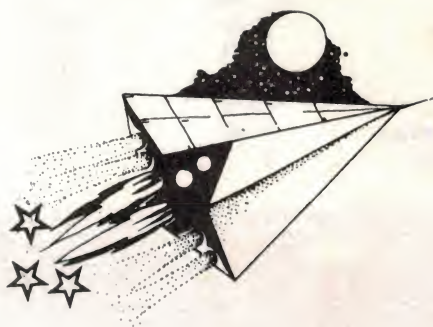
**energy CONTROL**

P.O. BOX 6502  
GOODNA 4300  
Phone  
(07) 288-2757

BANKCARD available for Australian & N.Z. customers. Same P & P for N.Z. & Australia. Prices subject to change without notice. Plus sales tax if applicable.



# '660 INVADERS



No set of computer games software is ever complete without including some form of the ubiquitous 'invaders' game. Here's the '660 version and a few tricks on how to score well.

The invading UFOs enter the screen area at top right and proceed across the screen at varying speeds. There are 'large' UFOs and 'small' UFOs. Your rocket launcher is at bottom centre of screen and keys 4, 5 and 6 launch your rockets. Key 5 launches them vertically, key 4 launches them angled to the left, key 6 launches them angled to the right. A 'hit' on a large UFO will score you 5 points ( ... it's easy!), a 'hit' on the small UFO scores you 15 points (harder). It takes some skill to score hits with key 6, but it's a little easier with keys 4 and 5. But watch it! — Timing your launch with key 5 is a little more critical than you think. In the right hand corner of the screen is a number showing how many rockets you have left. Your score is displayed in the left hand corner of the screen. Kill, kill!

Press 'RESET 8' to start a new game.

```
0600 A6 CD I=06CD
0602 69 38 V9=38
0604 6A 08 VA=08
0606 D9 A3 SHOW 3MI@V9VA
0608 A6 D0 I=06D0
060A 6B 00 VB=00
060C 6C 03 VC=03
060E DB C3 SHOW 3MI@VBVC
0610 A6 D6 I=06D6
0612 64 1D V4=1D
0614 65 1F V5=1F
0616 D4 51 SHOW 1MI@V4V5
0618 67 00 V7=00
061A 68 0F V8=0F
061C 26 A2 D0 06A2
061E 26 AC D0 06AC
0620 48 00 SKF V8#00
0622 16 22 GO TO 0622
0624 64 1E V4=1E
0626 65 1C V5=1C
0628 A6 D3 I=06D3
062A D4 53 SHOW 3MI@V4V5
062C 6E 00 VE=00
062E 66 80 V6=80
0630 6D 04 VD=04
0632 ED A1 SKF VD#KEY
0634 66 FF V6=FF
0636 6D 05 VD=05
0638 ED A1 SKF VD#KEY
063A 66 00 V6=00
063C 6D 06 VD=06
063E ED A1 SKF VD#KEY
0640 66 01 V6=01
0642 36 80 SKF V6=80
0644 26 D8 D0 06D8
0646 A6 D0 I=06D0
```

```
0670 16 86 GO TO 0686
0672 75 FF V5+FF
0674 84 64 V4=V4+V6
0676 D4 53 SHOW 3MI@V4V5
0678 3F 01 SKF VF=01
067A 16 46 GO TO 0646
067C 6D 08 VD=08
067E 8D 52 VD=VD&V5
0680 4D 08 SKF VD#08
0682 16 8C GO TO 068C
0684 16 92 GO TO 0692
0686 26 AC D0 06AC
0688 78 FF V8+FF
068A 16 1E GO TO 068E
068C 26 A2 D0 06A2
068E 77 05 V7+05
0690 16 96 GO TO 0696
0692 26 A2 D0 06A2
0694 77 0F V7+0F
0696 26 A2 D0 06A2
0698 6D 03 VD=03
069A FD 18 TONE=VD
069C A6 D3 I=06D3
069E D4 53 SHOW 3MI@V4V5
06A0 16 86 GO TO 0686
06A2 A6 F8 I=06F8
06A4 F7 33 MI=V7(3DD)
06A6 63 00 V3=00
06A8 26 B6 D0 06B6
06AA 00 EE RET
06AC A6 F8 I=06F8
06AE F8 33 MI=V8(3DD)
06B0 63 32 V3=32
06B2 26 B6 D0 06B6
06B4 00 EE RET
06B6 6D 1B VD=1B
```



# '660 Software

```

0648 DB C3 SHOW 3MI@VBVC
064A CD 01 VD=RND
064C 8B D4 VB=VB+VD
064E DB C3 SHOW 3MI@VBVC
0650 3F 00 SKF VF=00
0652 16 92 GO TO 0692
0654 A6 CD I=06CD
0656 D9 A3 SHOW 3MI@V9VA
0658 CD 01 VD=RND
065A 3D 00 SKF VD=00
065C 6D FF VD=FF
065E 79 FE V9+FE
0660 D9 A3 SHOW 3MI@V9VA
0662 3F 00 SKF VF=00
0664 16 8C GO TO 068C
0666 4E 00 SKF VE#00
0668 16 2E GO TO 062E
066A A6 D3 I=06D3
066C D4 53 SHOW 3MI@V4V5
066E 45 00 SKF V5#00

```

```

06B8 F2 65 V0:V2=MI
06BA F0 29 I=DSP,V0
06BC D3 D5 SHOW 5MI@V3VD
06BE 73 05 V3+05
06C0 F1 29 I=DSP,V1
06C2 D3 D5 SHOW 5MI@V3VD
06C4 73 05 V3+05
06C6 F2 29 I=DSP,V2
06C8 D3 D5 SHOW 5MI@V3VD
06CA 00 EE RET
06CC 01 7C
06CE FE 7C
06D0 60 F0
06D2 60 40
06D4 E0 A0
06D6 F8 D4
06D8 6E 01 VE=01
06DA 6D 10 VD=10
06DC FD 18 TONE=VD
06DE 00 EE RET

```

## PATTERNMAKER

This one's fascinating. You can have the computer draw a complex, varying 'kaleidoscope' pattern on the screen starting from a 'seed' pattern drawn by you. When you run the program, four spots appear in the centre of the screen, making a square block. Keys 2, 4, 6 and 8 are used to move the spots in each of the four screen quadrants to create the seed pattern. Key 2 moves the spots vertically away from the centre, key 4 moves the spots horizontally away from the centre, key 6 moves them horizontally towards the centre and key 8 moves them vertically towards the centre. When you've created your pattern, press key 0 and the computer will commence drawing the pattern out across the screen, continuously repeating it. Note that when the pattern crosses an existing line, the screen is blanked. Try this seed pattern: press key 2 four times, then key 4 four times, then press key 0.

The subroutine from 0632 to 0674 causes the pattern to be duplicated in the four quadrants of the screen.

```

0600 60 00 V0=00
0602 63 80 V3=80
0604 61 1F V1=1F
0606 62 0F V2=0F
0608 26 32 D0 0632
060A A6 00 I=0600
060C F3 1E I=I+V3

```

```

060E F0 0A V0=KEY
0610 F0 55 MI=V0:V0
0612 40 00 SKF V0#00
0614 16 1C GO TO 061C
0616 73 01 V3+01
0618 33 00 SKF V3=00
061A 16 08 GO TO 0608
061C 63 80 V3=80
061E A6 00 I=0600
0620 F3 1E I=I+V3
0622 F0 65 V0:V0=MI
0624 40 00 SKF V0#00
0626 16 1C GO TO 061C
0628 73 01 V3+01
062A 43 00 SKF V3#00
062C 16 1C GO TO 061C
062E 26 32 D0 0632
0630 16 1E GO TO 061E
0632 40 02 SKF V0#02
0634 72 FF V2+FF
0636 40 04 SKF V0#04
0638 71 FF V1+FF
063A 40 06 SKF V0#06
063C 71 01 V1+01
063E 40 08 SKF V0#08
0640 72 01 V2+01
0642 A6 77 I=0677

```

```

0644 6A E0 VA=E0
0646 8A 12 VA=VA&V1
0648 6B 1F VB=1F
064A 81 B2 V1=V1&VB
064C 3A 00 SKF VA=00
064E 72 01 V2+01
0650 6A F0 VA=F0
0652 8A 22 VA=VA&V2
0654 6B 0F VB=0F
0656 82 B2 V2=V2&VB
0658 3A 00 SKF VA=00
065A 71 01 V1+01
065C 6B 1F VB=1F
065E 81 B2 V1=V1&VB
0660 D1 21 SHOW 1MI@V1V2
0662 8A 10 VA=V1
0664 6B 1F VB=1F
0666 8B 25 VB=VB-V2
0668 DA B1 SHOW 1MI@VAVB
066A 6A 3F VA=3F
066C 8A 15 VA=VA-V1
066E DA B1 SHOW 1MI@VAVB
0670 8B 20 VB=V2
0672 DA B1 SHOW 1MI@VAVB
0674 00 EE RET
0676 01 80
0678 00 00

```





## THE 30 CM CONVERTIBLE: MONITOR AND T.V. SET



**\$139.50**

If you need a monitor for your computer, consider this dual purpose set. A fully-fledged B/W TV set with RCA input for your computer. Alternatively, you could use the set in conjunction with a video camera as a closed circuit TV system. A simple switch allows easy change-over from TV to monitor. Available only from:

## PHILIPS LOUDSPEAKERS

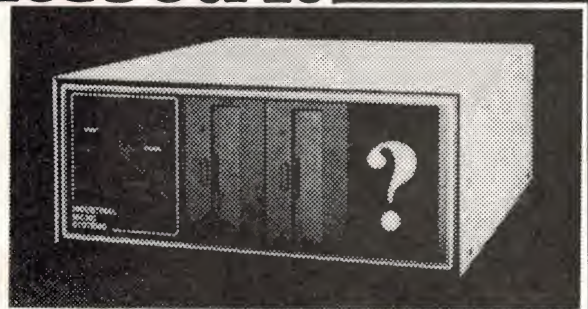
See us at Northpoint Hi-Fi for the new range of Philips loudspeakers and crossover networks. We have the ET1 4000 series speakers on display as well as other Philips kits. You can buy sets with or without boxes, any way you like. Come in for an audition, or write for further information.



# northpoint hi-fi

100 Miller St, North Sydney.  
Ph 922-7780.

# you may have guessed it over 6 Megabyte on a IMS 5000



## But it's the speed & reliability that counts

The IMS5000 with hard disk was benchmarked against all the other hard disk systems at the NCC Chicago USA '81 exhibition. On average 5.25 inch hard disk operates 15% faster than 8 inch Winchester, and it will not cost a fortune.

The demonstration system at the NCC was dropped and punctured in transit by a forklift, and it still came up first time without an error! This is the sort of rugged reliability users have come to expect from IMS International Computers.

Isn't this what you NEED? — A machine so reliable, its manufacturers warrant it for TWO years.  
— A machine so versatile, it operates under CP/M, MP/M, MVT-EFAMOS, USCD-PASCAL, MARC, MICROCOBOL;

— Yet a machine which is inexpensive and powerful. What system are you looking at purchasing? IMS! hope is at least on your short list. If not, Contact SI Micro and discuss your requirements with them. (The face is becoming familiar).

**SERIES  
8000  
SERIES  
5000**

**IMS**  
INTERNATIONAL  
COMPUTERS

**S.I. MICROCOMPUTER PRODUCTS PTY LTD**  
GPO BOX 72 SYDNEY 2001 92 PITT ST SYDNEY (02) 231 4091 232 6804  
Melbourne (03) 26-5522. Brisbane (07) 52-8455. Perth (09) 368-1800



# SIGHT & SOUND

## This year it's turntables at the Japan show



Nakamichi's 'Rolls Royce' turntable — the TX-1000. Multiply by ten for the price in dollars!

It doesn't seem like a year ago that Dennis Lingane reported for us on the wonders of the last All Japan Hi-Fi Show, but time rolls on and the Japanese R&D merchants have had a whole year in which to discover and develop new directions for the titillation of the audio buff. Last year amplifiers were the focus of attention; this year the spotlight switches to turntables and miniaturisation.

In Japan the whole audio industry seems to get onto the same technological kick at the same time (who said competition was the basis of capitalism?), and if it seems odd that they've all concentrated on improvements and new designs for the conventional turntable when PCM digital records (Pulse Code Modulation, for those who keep forgetting the jargon) are predicted to be all the rage by the end of the year, then it only goes to show that

**marketing has nothing to do with logic.**

The various manufacturers have taken different directions in their turntable designs, but many have followed the Technics SL10 concept and gone for miniaturisation; in the Technics example, the tonearm is enclosed in the hood of the player. Hitachi has a model which follows the exact dimensions of the Technics player, and Sanyo has a Technics lookalike but without the tonearm in the lid.

Pioneer has made quite an effort

in this new wave of turntable miniaturisation, with an ingenious unit measuring only twelve inches wide by nine inches deep (around 300 x 230 mm). How do you get a twelve-inch record onto a nine-inch turntable? Simple — you push a button and a front panel drops down, the record platter slides out, and a tonearm swings out from inside the box. However, we apparently won't be seeing this unit on sale in Australia, though for anyone wanting a really mini system it could be a good buy on an overseas trip.

While most manufacturers were heading for miniaturisation, Nakamichi have gone the other way. They have produced a new computerised turntable weighing around 35 kg, with its own intelligence that even sizes up faults in the pressing of your records and auto-

matically adjusts its mechanics to compensate. Priced at around \$5000 in Japan, it is expected to be nearer \$10 000 when released here! It comes with two tonearms and a third sensing arm which 'talks' to the on-board computer. A section of the turntable rises out of the plinth and the sensing arm swings out, settles onto the inner circle of the record and measures the imperfection of the pressing (caused in the casting and producing wow and flutter). This arm then tells the computer how far the rotation is out, and the turntable drive system is adjusted to compensate. All highly sophisticated!

Linn Sondek are cashing in on the latest fashion trend in order to compete in the Japanese market. Based on the current swing in Japan towards things English, Scottish



entrepreneur Ivor Tiefenbrun has come up with a Linn Club. Basically, anyone who buys a Linn Sondek product automatically becomes a member of the club and is entitled to wear the club tie (made in Jermyn Street, London, where all the best club ties come from, so we're told), and a blazer badge depicting a rampant red lion heavily embossed with gold thread. They can even get a wall plaque to hang in their home. The quality of the product seems to have got lost in the marketing somewhere along the line.

Still with turntables, Sharp have made a portable version of their up-right two-sided player, presumably so you can take it to the beach and get your record collection warped in the heat and the player clogged with sand.

The suction turntable also had a few followers at this year's show. This concept is basically a vacuum system which sucks the record onto the platter and gets rid of minor warps; the suction holds it flat while it's played. This technique is said to reduce resonance because the record and the platter become as one. Some credibility is given to the idea by the fact that Thorens has a suction turntable on the way.

With all this flurry over turntables, PCM, which is tipped to supersede them all anyway, was by no means ignored. Every manufacturer worth his salt had an integrated PCM digital player on show, and all the companies are very confident of the launch of the PCM disc by the end of 1982. They are even confident about the 'software' — i.e.: the records. For example, a Sony spokesperson says it has the assurance of its wholly-owned subsidiary Sony/CBS that the PCM discs will be in good supply by the time of the launch.

Getting away from turntables, it seems that the general trend in audio electronics is towards the 'midi' concept — i.e.: something between the mini-systems that have been trying for two or three years to properly establish themselves and the conventional (maxi?) systems. Hedging their bets? Such midi-sized systems are being offered by all manufacturers in the coming year, most featuring remote control not as an exclusive option but as a standard feature.

Another important trend in the ever-inventive electronics industry is towards the microcassette. According to Technics' charts showing the growth of the compact cassette and the microcassette in the marketplace, the growth of the Philips com-

pact cassette in the 1960s was exactly duplicated by the growth of the microcassette in the '70s. Technics maintain that compact cassette sales will level out in the '80s and the microcassette will catch it up.

Every hi-fi company showed microcassette stereo decks as part of their mini-systems range, and National Panasonic and Aiwa both had prototypes of microcassette car players. Portable stereo microcassette radios also abounded in the Akihabara (the electronic and electrical shopping suburb of Tokyo, where 200 multi-storey shops bulge with the latest in electrical and electronic equipment at the best prices in Japan). So there seems to be no doubt that in the domestic market at least the Japanese microcassette has quite a future in the next generation of hi-fi systems.

So — "Curiouser and curiouser", as Alice would say. PCM is on the way, but the conventional turntable has far from finished developing. Will the microcassette become the new market sensation, or will 'midis' sweep the board? No doubt the next All Japan Hi-Fi Show will offer a few answers — and plenty more surprises.

Dennis Lingane



## KLH to launch full product range in Australia

**KLH, who have become known in Australia for their computer-controlled loudspeakers, have recently merged with a major Japanese electronics manufacturer to launch a full range of KLH electronic products in Australia.**

The products will include amplifiers, receivers, cassette decks, tuners, a turntable and a budget range of loudspeakers. KLH promises quality with good value for money, and has an impressive record dating back to 1957 to back it up. For example, in 1959 the KLH Model 6 became one of the six all-time best-selling loudspeakers and was not discontinued until 1974, and in 1965 KLH was the first manufacturer to be licensed for Dolby and produced the first tape deck incorporating Dolby for domestic use.

As a prelude to the release of the full range of products, KLH has already made available the KLH Personal Stereo Cassette/FM Receiver. The headphones are ultra-light, using samarium cobalt magnets, and two headphone jacks are provided for tandem listening. A locking talk-through switch also allows for two-way communication. Rrp for this walkaround cassette deck/receiver is \$229.

## Double cassette deck from Sharp

**Hot on the heels of Sharp's bilateral turntable (which automatically plays both sides of a disc) comes the stereo double cassette receiver, which moves away from the traditional idea of three-in-one units now on the market for most household applications.**

Sharp's new unit, the System 700, features a double cassette deck with blending and editing facilities, linked to an AM/FM receiver producing 50 watts per channel, and stereo speakers.

"We are now offering three major household audio concepts," said Sharp's audio product manager Doug Thompson. "One is the VZ-3000, with bilateral turntable. There is the household components system, with amplifier, turntable, tape deck and so on. And now we have the System 700 with its double cassette deck for further flexibility. Each is designed to fulfil a specific

need, and the System 700 allows customers to bypass the turntable option if they want to by turning to tape instead."

The System 700 also includes APSS (automatic programme searcher system), metal tape capability and a Dolby noise reduction unit. The double cassette deck and tuner are linked to an inbuilt amplifier that delivers 50 W per channel through twin three-way speakers.

Suggested retail price for the system, with cabinet, is \$799. Further information may be obtained from Mrs. J.W. Lee Martin, (02) 922-6922.







## Sennheiser 'phones are light on the ears

Meet the latest thing in Sennheiser headphones — the new super-light, super-inexpensive HD 40. Strong on price to performance ratio, the HD 40 are said to have been designed to give the most discerning audio buff a good earful of the finest reproduction.

The HD 40 also have a special new feature that is very handy for storage; their driver system (that's the bit that goes over the ears) can be turned around the headband so that they can be laid flat. It also comes complete with 3 metres of cable.

Technical specifications for the

HD 40 are:

- Frequency response: 22 — 18 000 Hz
- Nominal impedance: 600.

For more information contact R.H. Cunningham Pty Ltd, P.O. Box 4533, Melbourne Vic. 3001, (03)329-9633, or P.O. Box 214, Neutral Bay Junction NSW 2089, (02)909-2388.

## Video industry group formed

The Australian consumer video industry, comprising all major suppliers and brands of domestic video recording and playback equipment, has formed an industry group. The group's spokesman, Mr. Gerry Gerlach, said that it had been formed to promote video as a home entertainment medium and to provide a forum for discussion of relevant information relating to industry trends and developments.

Mr. Gerlach explained that one of the group's main objectives will be to keep the media informed of developments within the video industry. The AVS group will provide an interface between the industry and the media.

Other organisations related to the home entertainment and video industries have already been formed,

and the AVS will co-operate with these other groups in the long-term development of the Australian video industry.

For further information contact Mr. G. Gerlach, Spokesperson, Australian Video Suppliers' Group, c/o G. Gerlach & Associates, P.O. Box 764, Chatswood NSW 2067, (02)419-7613.

## REACH FOR RALMAR...

## DECISION DIRECTORY

# P

- P.A. — Amplifiers; Microphones; Speakers; Transformers
- Patch cords
- Plugs — BNC; DIN; Phone; RCA; PL259

# R

- Plug adaptors
- Professional microphones
- Push switches
- RCA fittings
- Radio parts
- Rainbow cable
- Replacement — Cartridges; speakers

# S

- Record — Care kits; Cleaners
- Recording cables
- Shielded cable
- Siren
- Sleeving
- Slide switches
- Slow blow fuses
- Sockets
- Solar panel devices
- Soldering irons
- Spaghetti
- Speakers
- Speaker — Cable; Capacitors; Controls; Cross overs; Terminals
- Splitters TV/FM
- Stylus — Gauge; Microscope; Maintenance kits
- Switches



# RALMAR®

**JUST PART OF THE RANGE!  
AVAILABLE AT SELECTED  
STORES EVERYWHERE!**

### TRADE ENQUIRIES...

N.S.W. Ralmar Agencies P/Ltd (02) 439 6566  
Vic. Ralmar Agencies P/Ltd (03) 267 3028  
S.A. Charles Harwood P/Ltd (07) 264 1118  
QLD. Olbertz International P/Ltd (07) 261 1513  
W.A. Bruce Ingram & Assoc. P/Ltd (09) 381 7777  
TAS. George Harvey P/Ltd (003) 331 6533

RAL2/81



## Broadcast-quality video system from National

National's newly released ¾" broadcast-quality video cassette system is expected to be of interest to regional TV stations, advertising agencies, production houses and research companies because of its high performance and versatility.

The system consists of the direct drive model NV-9240 recorder, the NV-9600 editing recorder and the NV-A960 editing controller.

The NV-9600 editing recorder incorporates the facilities of earlier models, including the playback of tape recorded in NTSC, and also features a flying erase head and performs frame-by-frame edits.

The NV-9240 cassette recorder can be used as a master studio recorder, a dubbing deck, a source player, an editing system, or for

high-quality recording or playback. The NV-A960 automatic editing controller governs the performance of both insert and assembly edits and controls the selection of the desired editing mode.

The National Panasonic Series 9000 Video Cassette System is available through its Australian distributors, GEC Australia Ltd's Electronics Division. For further information contact Ian Nicholas on (02)212-5488.



## Best of both video worlds from Sharp

A VHS video recorder that combines the functions of a standard deck with those of a portable recorder was recently released by the Sharp Corporation.

Video recorders were previously aimed either at users who wanted to connect video to a television set for recording and replay, or at people who wanted a portable unit linked with a video camera for commercial or home movie use. The all-purpose video unit from Sharp is said to combine both functions in a new concept designed to give users the best of both worlds with one piece of versatile equipment.

Called the Video Champ 2300, the recorder operates in the same way as a standard video recorder when connected to a television set indoors. Outside, or at other locations away from mains supply, it can operate from its own battery pack or from a car battery.

Features of the Video Champ 2300 include:

- four-hour recording and playback with E-240 tapes
- fast forward picture search system
- freeze frame function
- eight-channel UHF/VHF tuner

- one-day, one-event programmable timer
- fine editing function

The recorder can be connected to any one of Sharp's three video cameras. Latest in the camera range is the lightweight XC-30, released by Sharp at the same time as the Video Champ 2300. Weighing only 1.4 kg, the compact camera also offers a collection of features:

- fixed focus 2x zoom lens with auto iris to eliminate focusing and exposure errors
- informative viewfinder, with low-light and battery warnings, plus recording indicator
- built-in condenser microphone
- built-in VCR start/stop trigger
- accessory shoe to carry lighting equipment.

The Video Champ 2300 is expected to retail at around \$1300, and the XC-30 camera at about \$700.

For further information contact Mrs. J.W. Lee Martin, (02)922-6922.



## Vector gear is grey, not green

If you were casting your eye over the Vector Research integrated amp and cassette deck displayed on page 2 of the December and January issues, you may have noticed a curious thing — the picture shows them as green.

Now, while Vector Research gear may be 'unconventional' in other regards — the designers went for 'no compromises' — the gear is not so far out on a limb as to be presented in green. After all, it would hardly fit in with 'Danish Modern' decor,

would it? Or most other domestic decors, for that matter. No, really, it's a quiet, refined gunmetal grey. Very suave.

The gear turned out green as a result of some error in the production process when the page was

made up. Murphy being an Irishman, naturally the error caused them to be green. Grrr.

Apparently there were also a few mistakes in the information we published about Vector Research products in the November issue. As stated, Vector Research hi-fi products will be distributed by a newly formed company, Keio International, as will Crown Radio cassette portables. However, other products distributed by Keio will be Altec Lans-

ing American loudspeakers, not DR Industries' Silcron and RMS ranges of speakers. Keio is also carrying only cassette portables from Crown Radio, not three-in-one systems as shown in the photograph in the November issue. The address for contacting Keio International is also different: 198 Normanby Rd, South Melbourne Vic. 3205. (03)64-3546/7/8/9.

Let's hope we've got it right between us this time.



## BEST VISION ANTENNA SERVICES

### MATV Systems

75 OHM 100% SHIELDED  
COAXIAL CABLE

#### FEATURES:

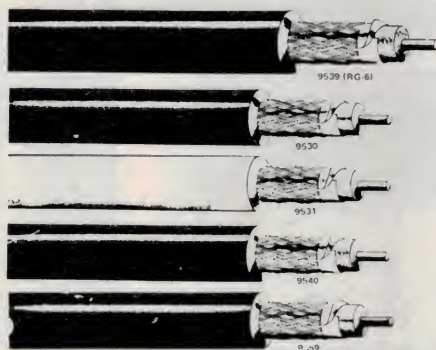
- Color-Duct is the lowest loss RG-59 type cable made for color TV reception.
- Electrically stable in high moisture and humidity.
- Available in high grade vinyl black and white jacket.
- Uses standard "F" fittings.
- 100% swept — meets all non-contamination requirements.

#### ALSO AVAILABLE FROM BEST VISION ANTENNA SERVICES.

is an extensive range of Antenna including **Channel Master Color Crossfire** series Models CX9 to CX28. All of your hardware requirements including Amplifiers and M-A-T-V Distribution Equipment which can be seen at our showroom.

### BEST VISION ANTENNA SERVICES

1117 Burwood Highway, Ferntree Gully, Victoria, 3156  
or telephone (03) 758 9111 for your local Channel Master Dealer.



# PEERLESS SPEAKERS

The name behind the big names in hi-fi!

Chosen for their high quality  
by the world's leading  
speaker makers!

Peerless is a world authority on loudspeaker design. In fact, many of the world's top hi-fi manufacturers select Peerless speaker components for inclusion in their own Brand Speaker Systems. Made in Denmark, Peerless speakers are incomparable for their high-power handling, smooth frequency response, low distortion and colouration.

Peerless speakers can be purchased three ways:—

1. Fully-assembled in timber cabinets — from bookshelf to floor-standing models.
  2. Speaker Kits — build-it-yourself and save up to 40% on assembled speaker prices.
  3. Individual speaker components to suit your exact hi-fi needs.
- Peerless makes speakers to suit amplifiers from 20-100 watts. For true-to-life sound, Peerless is the name behind the biggest names in hi-fi. Hear Peerless speakers at one of the authorised dealers below — or contact the sole importer for full technical details.

Sole Australian Importer: G.R.D. GROUP PTY. LTD.  
698 Burke Road, Camberwell, Vic. 3124. Trade Enquiries welcome.



**Peerless**

<b>N.S.W.</b> <b>Bondi Junction</b> Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (02) 387 5878 <b>Concord</b> Electronic Agencies Ph: (02) 745 3077 <b>Crows Nest</b> Deeva Hi-Fi Ph: (02) 439 3999 <b>Dee Why</b> David Ryall Electronics Ph: (02) 982 7500 <b>Wagga Wagga</b> Car Radio & Hi-Fi Centre Ph: (069) 21 4618	<b>VIC.</b> <b>Ballarat</b> Turner Audio Ph: (053) 32 2042 <b>Camberwell</b> Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (03) 82 7428 <b>Cheltenham</b> Beland Electronics Ph: (03) 550 2279 <b>Geelong</b> Steve Bennett Audio Ph: (052) 21 6011 <b>Hawthorn</b> Tivoli Hi-Fi Ph: (03) 818 8637 <b>Warrnambool</b> Bruce Henderson Audio World Ph: (055) 62 5147	<b>S.A.</b> <b>Adelaide</b> Hi-Fi Acoustics Ph: (08) 223 6774 <b>Adelaide</b> Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (08) 51 2124 <b>Goodwood</b> The Acoustic Foundry Ph: (08) 271 0276 <b>Hawthorn</b> Sound Craftsmen Ph: (08) 272 0341 <b>St. Peters</b> Miltronix Ph: (08) 42 3781	<b>W.A.</b> <b>Claremont</b> Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (09) 384 2852 <b>Kalamunda</b> Beale Charter Pty. Ltd. Ph: (09) 293 1512 <b>QLD.</b> <b>Brisbane</b> Brisbane Agencies Ph: (07) 221 9944 Audio Centre <b>Redcliff</b> Hi-Fi Sales Ph: (07) 284 2495 CONCORD/P5792
--	--	---	--



# Marantz Gold. Your New Recording Standard.



For over twentyfive years the name Marantz has stood for the ultimate in audio engineering brilliance and fidelity.

In keeping with this standard of technical excellence, the new Marantz Gold range of Cassette Decks with stunning designer element of brushed-gold finish now includes a recorder incorporating the latest in noise reduction processing.

The Marantz SD3030 Cassette Deck features the new Dolby C system to provide recordings with far less tape hiss than those made using standard Dolby B.

Unlike some other noise reduction systems, Dolby C recordings can be played back on a deck equipped with standard Dolby only without audible distortion or pumping effects.

Recording enthusiasts will be delighted by the other models in the new range.

Marantz Gold decks offer a variety of advanced features such as LED peak level meters on the SD1030, fine bias adjustment on the SD2030, and a motorized linear skating loading system on the SD5010.



All feature Dolby B noise reduction, compatibility with metal tapes, soft touch controls and DC Servo motors to ensure constant tape speed and silent operation.

So, set your standards high. And your recording standards higher.

See your local stockist and listen to the future. Listen to Marantz.

**marantz®**  
Now you're listening.



Decks shown in stack (from top): SD1030, SD3510, SD2030, SD3030 and SD5010.  
All decks shown with TDK Metal tapes.

Dolby and Dolby Systems are trademarks of Dolby Laboratories, Inc.

Copyright may exist on material you wish to record. Copying on such material requires the permission of the owner or owners.

Distributed by MARANTZ (Australia) Pty. Ltd. 19 Chard Road, Brookvale NSW 2100  
Telephone (02) 939 1900 Telex AA24121 Melbourne (03) 544 2011,  
Brisbane (07) 44 6477, Adelaide (08) 223 2699, Perth (09) 276 3706, Townsville (077) 72 2011

**Marantz Gold.**  
**The New Audio Standard.**



## New range of Marantz cassette decks

**Marantz (Australia) recently announced a new range of gold-fascia cassette decks with retail prices from \$179 to \$699. The series incorporates various advanced features, including microprocessor control on two models, linear skating cassette loading on two models, and compatibility with metal particle tapes on all models.**

Model SD3030 also features the new range, eliminating the old latest Dolby C noise reduction 'piano-key' controls in favour of soft touch controls. DC servo motors are employed in all models to ensure constant tape speed.

As well as adjustable tape bias to cater for all types of tape on all models, Marantz has engineered all the tape heads for long life, whilst on top-line models the heads are constructed of high-performance sendust alloy.

The tape transport mechanism is said to have been updated on the

Provision for real-time clock operation (for recording or playback at a predetermined time in user absence) is built into the SD9020 and the SD8020, and all other models have timer stand-by facilities for use with an external timer.

For more information contact Marantz (Australia) Pty Ltd, 19 Chard Rd, Brookvale NSW 2100. (02) 939-1900; telex: AA24121.

## More copyright confusion

**Consumers who have spent large sums of money purchasing expensive video recording equipment have recently been alarmed to read reports of a US Federal Court of Appeal decision suggesting that taping of television programmes on home video recorders, even for private and domestic use, is a copyright infringement.**

The United States decision, which is almost certain to be appealed against by the Sony Corporation, is in direct conflict with the stance taken by the United Kingdom Government, which in July 1981 published a 'Green Paper' rejecting similar claims which had been made by copyright owners in Great Britain seeking the imposition of a levy or tax on video equipment or video and audio blank tapes. The Australian Audio Video Tape Association (AAVTA) has called on the Attorney General's Department in Australia to end the confusion by taking positive action to legalise single copying of television programmes for private and domestic use.

The Association spokesman, Mr. P.A.G. Rose, points out that it is quite clear that Copyright Acts in all countries such as Australia, which are contracting parties to international copyright conventions, permit governments a certain amount of freedom to legislate in relation to private and domestic use and for education and research, without infringement of the basic rights of copyright owners.

Comprehensive American surveys point clearly to the fact that most video recorder owners use recorders for 'time shifting' — that is

watching their favourite programmes at a more convenient time — rather than for storage and repeated use. Traditionally, after watching, tapes are then erased and reused for the same purpose.

The imposition of any levy or tax on either blank cassette tape or video recording hardware would be to ignore the rapidly increasing rate of use of non-infringing portable video cameras instead of the old Super-8 home movies. In such cases Mr. Rose says there is no justification whatsoever for any levy to be charged for blank video tape as material recorded will be of an original nature.

The Association says that the stance taken by the United Kingdom Government is clearly the more practical approach, and the one which should be followed by the Australian Government. A common-sense solution along these lines can be achieved by including single copy private and domestic recording and specified educational recording in the 'fair dealing' provisions of the Copyright Act.

For further information contact Mr. Peter Rose, Vice-Chairman and Spokesman, Australian Audio-Video Tape Association, c/o 3M Australia Pty Ltd. (02)498-0033.



## TV wristwatch not far away?

**Standard Telephone and Cable (STC), based in London, recently demonstrated that the wristwatch TV is not an impossible concept by showing a display unit only 36 mm square and a few millimetres thick.**

This device is expected to lead to what STC describes as, "Probably the ultimate in display compactness and miniaturisation", and was shown at the recent New York international symposium of the Society for Information Display. STC's work in this field is backed by British Telecom and the UK Ministry of Defence because of its potential use in many types of pocket-sized equipment as well as telecommunications and aircraft instrumentation.

The unit has a liquid crystal display instead of the more conventional cathode ray tube, but unlike the LCDs used in most digital watches, the normal seven segments for each numeral in a watch are replaced by 1600 picture elements.

Built in at the back of the display is a large-area silicon chip which can provide all the electronic drive circuits needed for a display of such complexity, and dyes are used to give the device a range of colours. It is the first LCD of its kind to have a large-area integrated circuit incorporated into its structure.

Now that the 1600 picture elements version has shown that the concept works, scientists at the Standard Telephone laboratories are working on a display with 57 600 picture elements on a screen 69 mm square, to give good clarity.

According to STC, such displays need only very low electrical power, but are able to display, for example, a full page of teletext together with diagrams and graphics.



## The unconventional Yamaha B6

The Yamaha B6 amplifier is unconventional both in its appearance and in its power supply, which closely resembles that of the Carver M400, reviewed in an earlier ETI. Louis Challis discusses the similarities and differences between the B6 and both the Carver model and conventional power amps.

**Louis Challis**

THE RELEASE of the Yamaha B6 power amplifier in America and subsequently in Europe has created a good deal of interest from those technically aware of the attributes of an amplifier that does not use a conventional power supply. There are many parallels to be drawn between the Carver M400 (reviewed ETI, Nov. 1981) and the Yamaha B6 amplifier. Neither uses a conventional power supply, and although the literature provided by Yamaha is extremely sketchy, there is a strong likelihood from the power rating of the unit and the other general information provided that this is either a licensed version of the Carver principle or that it closely follows a similar path. Figure 1 shows the principle of operation (from the Yamaha literature). It has a remarkable similarity with the principles and art which Carver presents in his literature, but the description of the operation thereafter exhibits significant differences.

### How?

Yamaha describe the X power supply system as one in which unnecessary power dissipation is avoided by segmenting the ac sinewave power into precisely measured portions before it is fed to the power rectifier system. An optically coupled feedback loop controls the main power supply triacs, which turn on at precisely the right time during each power cycle, between 90° and 180° in each half-cycle. This switching is controlled by the instantaneous power consumption of the amplifier and thereby (in an analogous manner to the Carver system) achieves an exceptional output power performance without the

need for expensive power transformers or large and bulky filter circuitry.

Thereafter, claims made for the B6 are, if anything, more glossy and rosy than those made by Carver for the M400, but whilst Carver compares his amplifier to a conventional amplifier with a large power transformer and conventional output stage, Yamaha stress the difference between their unit and the efficiency of the latest Japanese

ing the X power circuitry: the B6, the A760, the A960 and the A1060. The power ratings of these amplifiers are not stated, so we presume that the B6 is the smallest of the series and that the other units overcome the voracious power demands that other high-powered amplifiers require to operate effectively.

Unlike Carver, Yamaha provide some very nice circuit schematics of the feedback control system and, more importantly, a very small schematic of the main amplifier circuitry. This tells us little about the operation of the amplifier except to show that it has two positive and negative voltage rails and a separate earth between which the transistors switch. By contrast the Carver amplifier has three positive and three negative rails. It seems from this that *there are a number of significant differences* in the electronic circuitry details between the Carver Amplifier and the Yamaha B6, and this review assesses some of the main features, similarities and differences.

### The B6

The unit which I received was not new, but it had one of the most unusual appearances of any amplifier we have seen in the last decade. For reasons best known to the designers they have avoided the inexpensive 'cube format' that Carver chose for their amplifier and instead have selected a truncated pyramid. This is a diecast cabinet featuring two bezel lights on the smooth front panel, with a large finned and ventilated heatsink at the back. Recessed back under the rear edge are two gold-plated coaxial phono-type input sockets,

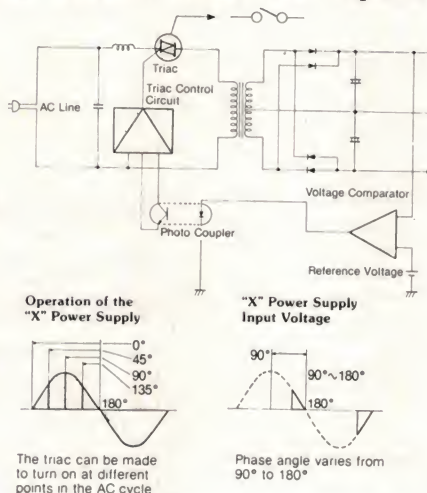


Figure 1. 'X' power supply circuit diagram and operation.

switching power supply systems as typically marketed, for example, by Sony (but they do not actually mention Sony). They also claim, in a similar manner to Carver, that the power supply output is virtually free from voltage 'spikes', so that no electromagnetic energy is radiated by the unit to interfere with the performance of high gain amplifier stages.

Yamaha offer four amplifiers featur-





**YAMAHA** NATURAL SOUND  
STEREO POWER AMPLIFIER "B-S"

two pairs of spring-loaded loudspeaker connection terminals, an earth terminal, a speaker on-off pushbutton switch and the mains lead. This is terminated with a three-pin plug for connecting directly to the normal power outlet.

Underneath the leading edge of the face is a pushbutton mains switch for turning on the power. Two bezels are provided, one for the power on and the second as an overload light. This protection light operates to indicate that the unit has been overloaded, particularly in those situations where excessive voltage or power is drawn or when short circuits are connected to the output of the system. Access to the unit's electronics is gained through the base but, rather surprisingly, after undoing all the screws on the base, the unit still did not seem to want to come apart. The base of the unit, like the top, is fabricated as a diecasting and incorporates more than 24 screws connecting

various sub-sections, which each had to be unscrewed before access could be gained to the control section of the printed circuit cards and electronics.

There are a few parallels between the construction of this unit and the Carver M400 amplifier unit, in that it is electronic component intensive. The printed circuits in this unit appear to be constructed to a higher standard than in the Carver amplifier, whilst the number of high-powered and medium-powered switching transistors and triacs appears to be even more numerous than in the Carver unit. With typical Japanese thoroughness the unit has been carefully laid out to assist the service organisations, and all the components and test points are clearly labelled and readily accessible.

Once again the only real complication is to get the unit fully apart because of the large numbers of screws required to disassemble it. I never succeeded, nor did the editor, who also tried valiantly.

It seems possible that Yamaha may have spent as much on their diecastings as they might have spent on a transformer, and only Yamaha's sales and costing personnel can answer that criticism.

### On test

The specified ratings for this amplifier have been presented in a different way from the Carver M400, thereby making a direct comparison more complex. Whilst the power output and total harmonic distortion is stated as being 200 watts, most of the other performance factors relate to the 100 watt level, at which point we would expect the unit to perform better, and so it does. The frequency response is impeccably flat, being within 0.5 dB from 10 Hz to 100 kHz. Yamaha utilise faster switching transistors than Carver and faster triacs in their power supply, and thus achieve a substantially greater bandwidth than the Carver M400 amplifier ►

To page 131



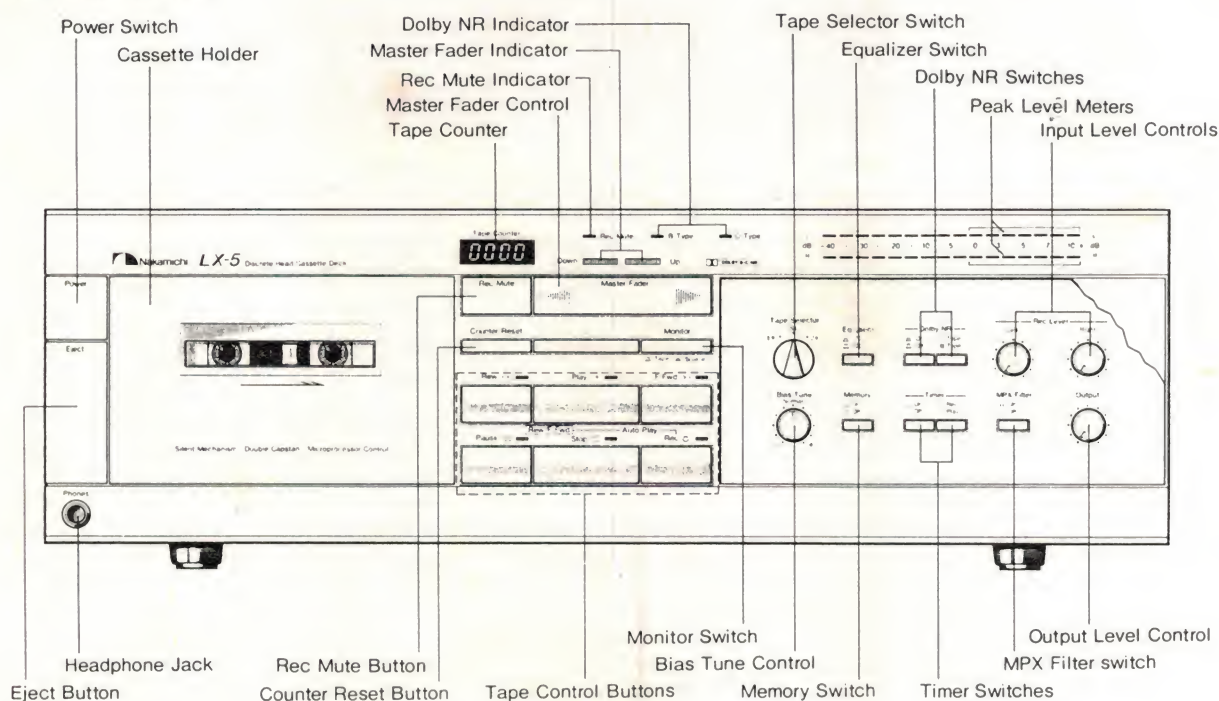
# LX-5/LX-3



## Nakamichi Corporation

The LX-5 and LX-3 follow the same elegant design trend initiated by the Nakamichi 700ZXL and 700ZXE. A wide central belt of silver holds the cassette door, main transport controls, and a hinged panel which swings down to reveal additional controls. Above and below it are black bands, the upper one containing an array of LEDs: the meters, tape counter, and other indicators. Both models also incorporate advanced Nakamichi features found in our top-line decks: the Asymmetrical, Diffused Resonance, Dual Capstan Transport, the Discrete Three Head system (LX-5), and Dolby C-type noise reduction.

By offering increased transport control flexibility in combination with elegant styling and excellent all-around performance, the LX-5 and LX-3 are impressive additions to the Nakamichi line.



**LX-5 Front Panel (showing controls behind the hinged panel)**



Forging new  
frontiers in speaker  
performance

**Richard Allan**

top quality  
English speakers

The Richard Allen Power  
Range is now available in  
Australia.

MODEL	POWER HANDLING RMS WATTS	SENSITIVITY PEAK
Atlas 10	125	110
Atlas 12	125	110
Atlas 15	250	110
Atlas 18	250	108

Professional advice on all facets of speaker  
design and construction available.  
Come and inspect our unique  
experimental speaker design  
facility.



The  
**ACOUSTIC  
FOUNDRY** Hi Fi

56 King William Road, Goodwood 5034  
(08) 2710276.

Please forward me further details  
on Richard Allan speakers.

(Trade enquiries also welcome).

(Sep-Feb) (Please include a note specifying area of interest)

NAME .....

ADDRESS .....

..... POSTCODE .....

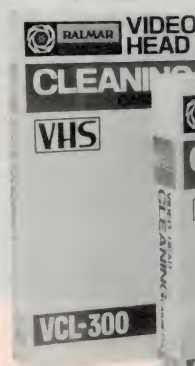
## REACH FOR RALMAR...

### HOME VIDEO HEAD CLEANERS

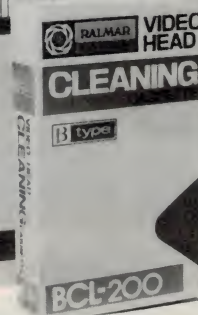
The heads on your home video are far  
more sensitive to dust and residue  
than a normal tape recorder.  
For the utmost in picture quality,  
recording or playback, the heads on  
your machine must be cleaned  
regularly.

Use a RALMAR Head Cleaner

VHS



BETA



### TV/FM SPLITTERS

Simple do it yourself installation.  
Connect more than one TV from the  
one antenna, OR an FM tuner and TV  
from the same antenna. The  
combinations are almost endless.



CHECK RALMAR for  
**BALUNS, SPLITTERS,  
FLYLEADS,  
CABLE AND  
CONNECTORS.**

RAL 1/82

#### TRADE ENQUIRIES...

N.S.W. Ralmar Agencies P/Ltd (02) 439 6566

Vic. Ralmar Agencies P/Ltd (03) 267 3028

S.A. Charles Harwood P/Ltd (07) 264 1118

QLD. Olbertz International P/Ltd (07) 261 1513

W.A. Bruce Ingram & Assoc. P/Ltd (09) 381 7777

TAS. George Harvey P/Ltd (003) 331 6533

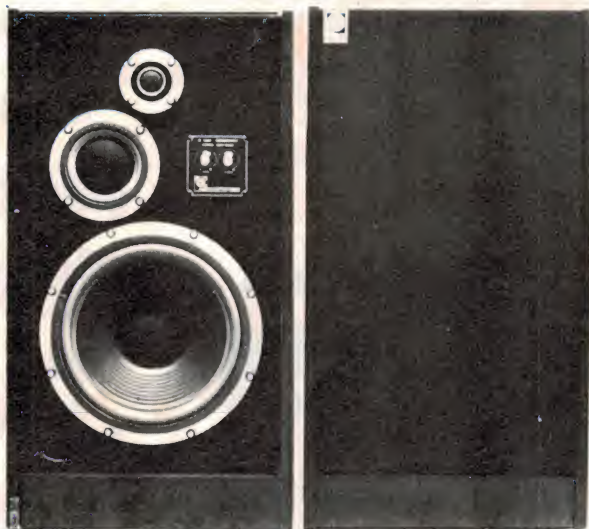
**RALMAR®**



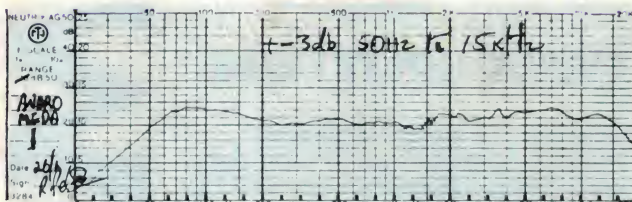
# THE NEW BREED!

- ★ INCREDIBLE TRANSIENT RESPONSE
- ★ STABLE STEREO IMAGE.
- ★ WIDE DYNAMIC RANGE.
- ★ HIGH POWER D.C. AMP. HANDLING.
- ★ MONITOR STUDIO PERFORMANCE
- ★ HANDLES DIGITAL PROGRAMMING

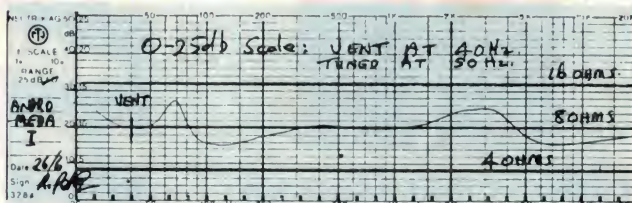
## MODEL: ANDROMEDA I



**rrp \$995<sup>PR</sup>**



FREQUENCY GRAPH: CALIBRATED. 0 - 50 db Scale



IMPEDANCE GRAPH (Z) CALIBRATED. 0 - 25 db Scale

### GENERAL DESCRIPTION

The series one was developed from the more famous series two, using a smaller enclosure, and a single mid-range, but same crossover and components as the two. We detected only a slight loss in dynamic range, but a slightly richer, more enhanced deep bass end. Rock, middle of the road, and jazz, seemed to be their forte, although every digital classic we put through them gave an overwhelming performance. Still cannot find anything to better them in the price bracket, even up to twice the price.

### CABINET MATCHING:

790 mm deluxe in veneer only.

SOUND PRESSURE LEVEL: 1 watt. 1 meter 94db.

SHIPPING: 1 only per carton (matched pairs)

### WEIGHT

	IN CARTON	OUT OF CARTON
	32.8 kg.	32.00 Kg.

### DIMENSIONS:

Height	860 mm	790 mm
Width	480 mm	430 mm
Depth	460 mm	390 mm

### SPECIFICATIONS:

TYPE: Reflex twin tuned port  
 SYSTEM: 30 cm (12") 3 way, 3 element  
 MAXIMUM RATING: 120 watt R.M.S.  
 MINIMUM PREF. DRIVE: 15 watts (8 ohm)  
 DRIVER SIZE: 30cm (12")  
 CAPACITY: 76 litre  
 Baffle: 26mm heavy braced  
 COLOURS AVAIL: Sen Ash — Oak Veneer  
 ATTENUATION: Mid and high constant  
 CROSSOVER TYPE: Inductive — capacitive — resistive  
 CROSSOVER frequ: 360 Hz, 5 k Hz  
 MIDRANGE ROLLDOWN: 6db.  
 MIDRANGE ROLLOFF: 6db.  
 DRIVER ROLLOFF: 6db.  
 TWEETER ROLLDOWN: 18db.  
 TWEETER ROLLOFF: N/A  
 SUPERTWEETER ROLLDOWN: N/A  
 FREQUENCY RANGE: 20 Hz to 20 k Hz  
 EFFECTIVE RANGE: 40 Hz to 20 k Hz

ALL GRAPHS ARE LIVE ENVIRONMENTAL

ALL S.P.L LEVELS ARE CALCULATED FROM A PINK NOISE SOURCE, 1 WATT, 1 METER.

(THIS IS, WE FEEL, A MORE ACCURATE INDICATION OF MUSICAL LISTENING LEVELS, THAN RANDOM SPOT FREQUENCY METHODS.)



## PETERSON SPEAKER LABORATORIES P/L

AVAILABLE AT SPECIALISED AUDIO OUTLETS ALL OVER AUSTRALIA.

FOR INFORMATION WRITE: ANDROMEDA I

11 FURY COURT CLAYTON SOUTH MELBOURNE, 3169.

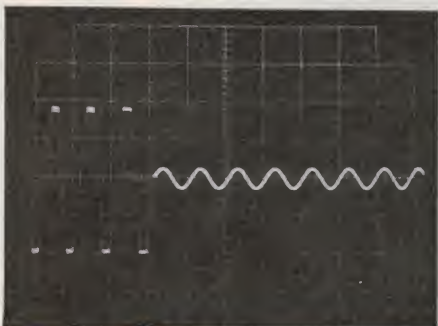


From page 127

Transient overload recovery test (IHF-A-202). 10 dB overload re rated power into 8 ohms — both channels driven. Overload duration: 20 ms; repetition rate: 512 ms.



1 ms/div.



50 ms/div.

does. The total harmonic distortion at 200 watts is typically 0.016% at 90 Hz, 0.009% at 1 kHz and 0.0046% at 6.3 kHz. This is higher than the manufacturer's claims of 0.003% but is nonetheless a good performance. At the one-watt level the manufacturer's claims are more closely approached, although are again slightly exceeded at the 1 kHz and 6.3 kHz test frequencies.

The residual hum and noise related to the 1 W level is excellent, being -88 dB (unweighted) and -89 dB (A-weighted). This similarity to the S/N ratings of the Carver amplifier for the unweighted and A-weighted levels comes as a result of the commutation noise components measured, and these figures are less meaningful in the overall analysis, as the attached photographs make visually apparent.

Channel separation is excellent, being typically better than 72 dB at any frequency up to 20 kHz.

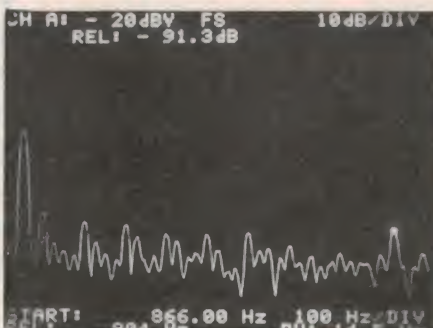
We repeated the measurements which we performed on the Carver amplifier utilising our fast Fourier analyser, which can look at full frequency bandwidths in rapid time, to determine the harmonic components of the drive signal and related low-level components using a 900 Hz 200 W tone-burst signal, and to determine the

relativity between commutation noise and the harmonics at 180 Hz and higher frequencies. As can be clearly seen from the photographs, the harmonics and commutated 50 Hz components inter-related with those harmonics are particularly high. The 350 Hz component, which is highlighted, is only -66.8 dB relative to the fundamental (which has been preattenuated in the measurement chain prior to taking the photograph). This amplifier is thus similar to the Carver, with the commutation noise components rising with increasing signal power output.

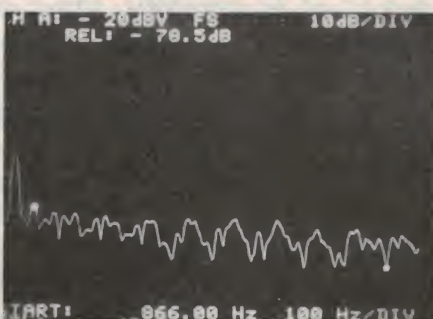
## Subjectively

The subjective testing of the amplifier we were using (which had been used by others before us) was temporarily slowed down by the untimely demise of the unit just as I started performing my ritual evaluation at home. The failure involved the total loss of power, but the fuse whose failure I presumed to be the root cause of the trouble was nowhere to be seen. I had already tried to open up the unit without success, so I finally handed it over to the importers, who arranged for another unit to be reviewed.

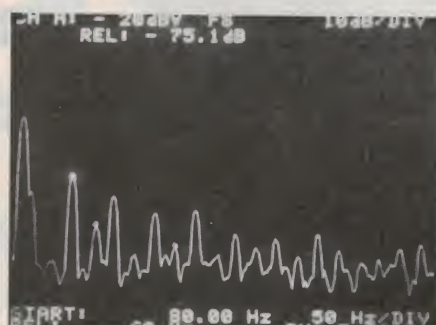
This new unit exhibited no problems whatsoever, and I must presume that the prototype unit had either been



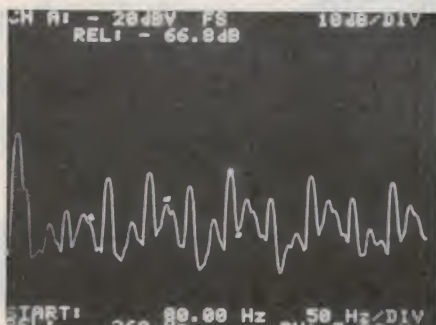
1 watt at 900 Hz rejected by null filter.



2nd harmonic, last DIP. Note 50 Hz modulation @ 950 Hz. 200 watts @ 900 Hz rejected null filter.



1 watt at 90 Hz, max. peaks -75.1 dB of fundamental. Max. peak is -75.1 dB cf. fundamental.



200 watts at 90 Hz, fundamental rejected and harmonics included with white spots. Peak noise signal indicated by marker.

abused or had some other deficiency. After connecting up the B6 amplifier to a Yamaha C4 preamplifier, I was able to perform a subjective evaluation in which the B6 amplifier was compared directly with a Yamaha M2 amplifier. This has a similar peak rating but is a conventional class B amplifier with all the attributes (or vices) of that class of amplifier. The M2 is an excellent amplifier with a peak power rating well in excess of the manufacturer's 200 W stated output, and has proved itself to be eminently suitable for loudspeaker testing, for which it has been used extensively in the last few months.

The test set-up I chose for the loudspeakers was to connect two pairs of high-quality monitor speakers, each with the ability to handle the peak power rating. Instead of the normal A-B set-up I placed one of the first type in each A channel and one of the second type in each B channel of the two amplifiers. By this means the lack of two matched pairs was satisfactorily overcome and it became possible to directly compare the two amplifiers (rather than the speakers).

The Yamaha B6 amplifier performs remarkably well, in general terms as well as the M2 does, all the way up to the 200 W peak output. At output levels in the range 60 W to 200 W there is the

To page 134



# STOP

**Wasting time, effort, energy, solder.**

This book will save you so much you'll wonder what you did before we published it!



## **CIRCUIT TECHNIQUES VOL. 1**

**Only \$4.75**

CIRCUIT TECHNIQUES Vol. 1. is a collection of 16 practical articles covering techniques and applications for some of the most widely used semiconductors in electronics — such as op-amps: from 741s and 3140s to 3080s; not to mention such lowly items as diodes, LEDs and zeners; then there's VFETs, MOSFETs and Schmitt triggers. And to round it out there are articles covering potcore inductor design, active filter design and crystal oscillator techniques.

Save yourself trouble. Don't dig through device application notes in search of a circuit to modify, start off on the right foot with Circuit Techniques Vol. 1. You'll probably get closer to where you want to be with fewer hassles. It's an invaluable reference for every electronics enthusiast, experimenter, technician or engineer.

*Available from newsagents, selected electronic suppliers or direct from ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Please add 65 cents for post and handling if buying by mail order.*



# Not Just Speaker Wire



Conventional speaker wire limits the performance of your sound system by decreasing power output, restricting dynamic range, and reducing clarity and definition. You can significantly improve the performance of your audio system by switching from your present speaker wire to Monster Cable.

Constructed of over 500 strands of high purity copper in a unique configuration, Monster Cable is specifically engineered for low resistance, low capacitance, and low inductance. The Results?

Deeper, tighter bass.

Maximum power transfer.

Increased clarity and definition.

Wider dynamic range.

Even low-powered systems show a remarkable improvement. Recommended by leading audio manufacturers, Monster Cable is safe to use with all amplifiers and receivers, regardless of design.

Don't be deceived by imitations. If it doesn't say Monster Cable you're not getting all the performance you paid for.

## MONSTER CABLE

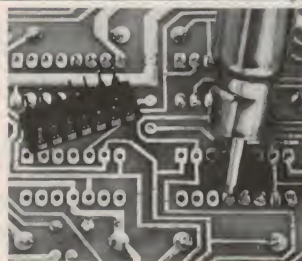
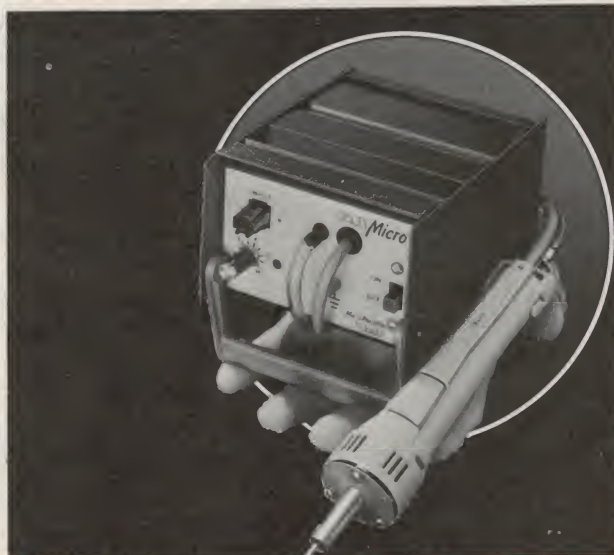
DISTRIBUTED BY CONVOY SYDNEY (02) 358 2088

Available from: **N.S.W.**—DUTY FREE TRAVELLERS SUPPLIES Sydney • CAMPBELLTOWN HI FI Campbelltown • LEISURE SOUND City, Parramatta, Artarmon • NEWCASTLE HI FI Newcastle • PITMANS Wagga • RUSSIN ELECTRONICS Ashfield • DAVE RYALL ELECTRONICS Dee Why • SPRINGWOOD HI FI Springwood • TAMWORTH HI FI Tamworth • LEN WALLIS AUDIO Lane Cove • WOOLLAHRA ELECTRONICS Woolahra • WOLLONGONG HI FI Wollongong • EASTERN HI FI Newcastle • ACT—DURATONE HI FI Phillip • KINGSTON HI FI Kingston • VICTORIA—NATSOUND Melbourne • BOON SOUND Wodonga • EAST COAST AUDIO Albert Park • SOUNDCRAFTSMAN Nth. Caulfield • TIVOLI HI FI Hawthorn • STEVE BENNETT AUDIO Geelong • QLD.—DISCO & STEREO SUPPLIES Townsville • GOLD COAST HI FI Southport • HANCO HI FI Toowoomba • HI FI SALES Redcliffe • HIGHWAY SOUND Mt. Isa • REG MILLS STEREO Buranda • STEREO SUPPLIES Brisbane • STEREO WORLD Cairns • **STH. AUST.**—ASLIN HI FI Mt. Gambier • BLACKWOOD SOUND Blackwood • GRENELL PLAZA HI FI Adelaide • SOUNDCRAFTSMAN Hawthorne • TRACK HI FI Adelaide • **W.A.**—ALBERTS Perth • E. Victoria Park, Balga, Freemantle • THE AUDIO CENTRE West Perth • AUDIO DISTRIBUTORS Mosman Park • JAPAN HI FI Victoria Park • LESLIE LEONARDS HI FI East Perth • NORTH WEST AUDIO Karratha • **TAS.**—BEL CANTO Hobart • UNITED ELECTRONICS Launceston • **N.T.**—RADIO PARTS Darwin.

# DESOLDERING REPAIR PCB'S ANYWHERE

## With the NEW Pace Micro

Perform power desoldering and soldering anywhere.  
Depot. Service Centre.  
Mobil Van.  
Anywhere.



## PAGE

Micro Portable

## COLTRONICS

8 Gipps Rd., Greystanes 2145

Sydney: (02) 636 7211

Melbourne: (03) 818 0734

New Zealand: WAIKANAI 6739



# SOUND review

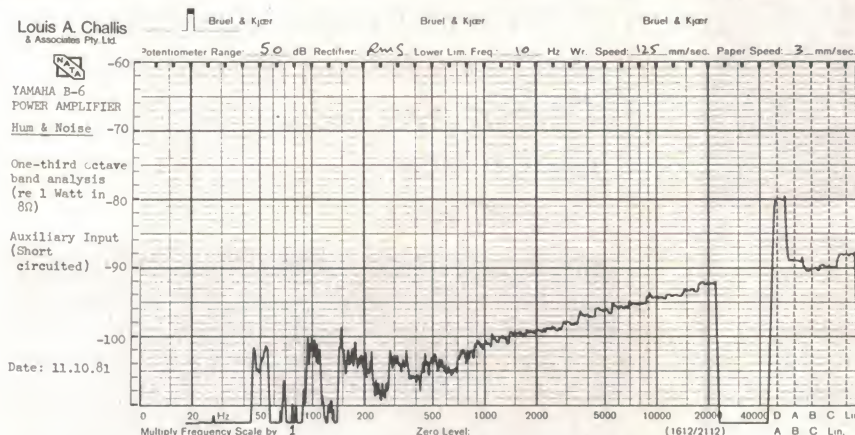
From page 131

faintest trace of an increase in dynamic noise figure, but detecting this was particularly difficult not only for me, but also for other experienced listeners whose assistance I sought. Surprisingly, this phenomenon was a little less pronounced in the B6 than it was in the Carver M400, for which I can give no explanation. At moderate levels, which are power outputs of less than 50 W, the B6 Amplifier is completely indistinguishable from the M2 amplifier. Put

more simply, at these levels the B6 performs in all respects just like any other conventional high-quality amplifier. Of course it draws less power, has an unusual appearance, and is if anything, rather esoteric.

The B6 amplifier is unquestionably 'state of the art', for it provides excellent performance over most of its range and does most, but not all, of the things claimed for it by its manufacturers. The dynamic noise problem which we

discovered in the Carver amplifier is less pronounced but still just detectable, although it would not be detectable by the above average listener except when performing an A-B test with the same zeal that we exercised. Basically, the B6 amplifier achieves a noteworthy performance and its attributes far outweigh its limitations. However, at a recommended retail price of \$1399 it does not necessarily reflect the same value for money as other 200 W amplifiers, even allowing for a five-year warranty, which only 'softens the blow'.



## YAMAHA B6 AMPLIFIER

Dimensions: 290 mm wide, 176 mm high, 290 mm deep  
 Weight: 9.2 kg  
 Price: \$1399 rrp  
 Manufacturer: Nippon Gakki, Japan  
 Distributor: Rose Music, 17-33 Market St, South Melbourne Vic. 3205.

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.



## MEASURED PERFORMANCE OF YAMAHA POWER AMPLIFIER B-6 S.N. G04800

### HARMONIC DISTORTION:

(A) (At Rated power of 201 Watts into = 40.1 Volts)

	90Hz	1kHz	6.3kHz
2nd	-83.0	-84.0	-86.7 dB
3rd	-77.6	-85.7	-dB
4th	-85.0	-90.0	-dB
5th	-	-92.0	-dB
THD.	0.016	0.009	0.0046%

(B) (At 1 Watt into 8Ω)

	90Hz	1kHz	6.3kHz
2nd	-90.7	-89.0	87.7 dB
3rd	-	-	-96.0 dB
4th	-	-	-dB
5th	-	-	-dB
THD	0.0029	0.0035	0.0044%

TRANSIENT INTERMODULATION DISTORTION: Very low: Less than 0.1%

(3.15kHz square wave and 15kHz sine wave mixed 4:1)

### NOISE & HUM LEVELS:

re 1 Watt into 8Ω AUX -88 dB (Lin) -89 dB(A)  
 (with volume control set for 1 Watt output with, 102mV input (Aux))

### MAXIMUM OUTPUT POWER AT CLIPPING POINT:

(IHF -A- 202)

(20ms burst repeated at 500ms intervals)

134 V P-P

= 281 Watts

Dynamic Headroom = 1.4 dB (re 201 Watts)

### FREQUENCY RESPONSE:

(-3dB re 1 Watt, 0.5V

Left <1.0 to >100kHz

Input to Aux)

Right

### SENSITIVITY:

Left Right

(for 1 Watt in 8Ω)

AUX 102mV 100mV

### INPUT IMPEDANCE:

Left Right

AUX 22kΩ 22kΩ

OUTPUT IMPEDANCE: = 27 milliohms (@ 1kHz)



**NEW  
FROM  
SHURE**

**StarMaker™  
SERIES**

**SM77 • SM78**  
**cardioid dynamic microphones**  
**that give you great sound,**  
**outstanding performance . . . and looks.**



SM77EB

SM78TN

SM77TN

SM78EB

Starmaker new light heavyweights are around 28% lighter than similar stage microphones. Yet they offer everything you've come to expect from Shure—consistently high performance, tailored frequency response, ruggedness and reliability. And they're available with or without cable.

**The Starmaker SM78** is "first choice" for rock, pop, R & B, country, gospel and jazz vocalists. Available in colour choice of black or tan.

**The SM77** is especially effective on instrumental pick-up where brilliant and defined sound is demanded. Available in colour choice of black or tan.

#### **CHECK THESE GREAT FEATURES**

**Lightweight, tough . . .** aluminium alloy case, 28% lighter, rugged as ever.

**Enhanced intelligibility and sound . . .** tailored frequency response, upper and mid-range presence peak.

**Durable, good looking finish . . .** exclusive SUEDECOAT™ finish—tough, non-reflective, rust and tarnish resistant.

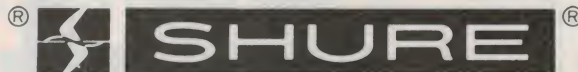
**Custom designed carrying case . . .** cushions and protects against vibration or shock. Included at no extra cost.

#### **CHECK THESE SPECIFICATIONS**

Frequency Response: 50-15,000 Hz.

Polar Pattern: Cardioid (unidirectional), rotationally, symmetric about axis, uniform with frequency.

Impedance: Microphone rating impedance is 150 ohms (180 ohms actual) for connection to microphone inputs rated at 19 to 300 ohms.



send this coupon to:

AUDIO ENGINEERS, 342 Kent Street,  
SYDNEY, N.S.W. 2000. Tel. 29 6731.

Please send me your 'free' brochure on Shure  
"StarMaker" series. (PLEASE PRINT) Name & Address

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Postcode: \_\_\_\_\_ ET1581

For technical service and advice, contact the Audio Engineers representative at the office in your State:—

AUDIO ENGINEERS PTY. LTD.  
342 Kent Street,  
SYDNEY, N.S.W. 2000.

AUDIO ENGINEERS (Vic.)  
2A Hill Street,  
THORN BURY, Vic. 3071.

ATHOL M. HILL P/L  
Unit 5/66 Wellington Street,  
PERTH. W.A. 6000.

AUDIO ENGINEERS P/L (Qld.)  
51A Castlemaine Street,  
MILTON, Qld. 4064.

NOMIS ELECTRONICS P/L  
689 South Road,  
BLACK FOREST, S.A. 5035.

HAWKINS AE162



# "How we chose the Wheels Car of the Year."

Peter Robinson

"This year there were six finalists for Wheels Car of the Year.

Audi 5+5  
Datsun Bluebird  
Datsun Skyline  
Honda Accord  
Mercedes-Benz S-class  
Toyota Celica.

"But this year was very different. I had some help. And pretty impressive help it was, too.

Alan Moffat, one of the best drivers in Australia, certainly the best known. With three "Bathursts" under his belt. Evan Green, once p.r. man with GM and Leyland, long time motoring writer for the Sun-Herald. Dimitri Caplygin, executive engineer Girlock, perhaps the finest brake engineer in the world. David Bentley, industrial designer and car stylist, fathered the Kimberley and Tasman. Mike McCarthy, technical editor, Wheels.

"The plan was to take off for three days, cover at least 1500 kilometres in each car, swapping drivers each 100 kilometres or so.

"The route: Sydney to Castlereagh drag strip for electronic measuring of base performance - acceleration, braking, speed tests. Then south to Goulburn Queanbeyan and the climb to Cooma. Overnight.

Day 2: through the Snowy to Victoria and down to Omeo. Up through the Kiewa Valley for Night #2 at Albury.

Day 3: Albury to Tumbarumba, Tumut, Yass, Goulburn, Sydney. The run would test the

works; suspension, performance, interior comfort and vision, fuel economy, safety, driveability, cornering, fatigue. On freeways, two lane bitumen, back roads, dirt, peak-hour city, night time country. The works.

## DAY #1

"I picked up Moffat from the Hilton at 6.55 am. I was five minutes early and he was waiting. We drove in the Benz. Evan met us in the Skyline I'd given him at dinner the night before (at Puncinella,

in the Cross, fantastic meal, had a great yarn...but that's another story).

Sydney's roads are so terrible it took an hour to get from the city to Castlereagh.

"We stayed till 1.00 doing the tests.

And already the cars were starting to sort themselves out. One which looks a million dollars went like five cents...you would not believe it.

"Funny thing we fast realised. As editor of Wheels I'm hard on cars when I get behind the wheel. That's my job. But to someone like Moffat...he's never canned a car in his life. He's been taught to mother them along so they last the race. All measurements were taken with a gadget called the Correvit. It's fixed with suction caps to the side of the car and monitors everything that happens from acceleration to braking. It takes the human factor out of assessment.

"Moffat remarked as we sat over dinner in Cooma that he was driving more kilometres in three days than he had in ten years in Australia. Seems Alan only drives from his home to the airport at Tullamarine.

"Moffat soon

made up for it. So did we all. Drive an hour or so. Stop. Swap notes. Change cars, drive another hour. Stop. File reports. Swap cars and take off again.

## DAY #2

"The most beautiful countryside



I reckon is between Cooma and Omeo. Amazing. One minute we're all sprouting Banjo Patterson, the next the mountains flatten out to picture-book rolling hills. Again it's swapping cars. By now two or three makes are out of contention. No one says so but each of us quietly knows it. Day Two is a day of ups and downs. Literally. Mountain after mountain. Bend after bend. We arrive at Albury at 10.30 pm. The cars are in better shape than us.

## DAY #3

"By now I'd chosen 'my' Wheels Car of the Year.



One by one I checked with the other drivers. I asked them to rank their best cars in each of six categories.

One: Advancement in design.  
Two: Engineering excellence.  
Three: Value for money. Four: Safety.  
Five: Utilisation of resources.  
Six: Performance of intended function.

I tallied the answers and there was a clear winner. We drove home to Sydney."

Read Peter Robinson's full report in February Wheels. There's seven pages on the winning car and two pages each on the five runners up.

Wheels Car of the Year.



# Wheels, February, now on sale.



# 'The quality remains after the price is forgotten'

Henry Royce, founder of Rolls-Royce, 1906.

## SHURE ANTI-STATIC PISTOL

The new red Zerostat Pistol is the latest version of a leader in its field. The simplest way to remove static and its associated symptoms. Needs no refills, batteries or power supply and neutralises static charges in seconds. Lasts for at least 50,000 operations. **\$24.95.**

## New discwasher® DISCKIT

Combines the Zerostat Anti-static pistol, Discwasher D-4 Record Cleaning System and Discwasher SC-2 stylus cleaner in a handsome walnut storage tray with smoked perspex dust cover at a significant cost saving over the individual components. **\$69. Save 22%.** Discorganiser, the walnut tray and the perspex lid are available separately for just **\$25.**

## New discwasher® D4 RECORD CLEANING SYSTEM

New formula D-4 fluid removes dust, dirt, even fingermarks, whilst protecting the vinyl record surface. Walnut mounted D-4 fabric pad has extra soft directional fibres to absorb fluid and contamination, leaving record surface entirely free of contamination or residue of any kind. DC-1 pad cleaner keeps the fabric in good condition for maximum efficiency. **\$24.95.**



Available now from  
hi-fi and record stores.

from  
**ZEROSTAT**

and  
**discwasher®**

Sole Australian  
Distributors

**arena**  
DISTRIBUTORS

## New discwasher® SC-2 STYLUS CLEANER

SC-2 Stylus Cleaner fluid is formulated to disperse not only harmful grit, but also the very vinyl additives which D-4 fluid protects and which can clog styli. SC-2 brush, with bristles of a calculated density and texture, removes dirt without damage to delicate stylus cantilevers. Reverse of brush is a magnifying mirror for easy stylus inspection. **\$13.95.**

642 Albany Highway, Victoria Park, W.A. 6100.  
Ph: (09) 361 5422 Telex: 93299



## Pageant Series II loudspeakers

The Pageant Series II loudspeakers, manufactured in England by the relatively unknown company (to Australians) Mordaunt Short, are excellent for the classical or light music buff, according to Louis Challis. However, if you're into hard rock they most probably won't give you the performance you're looking for.

**Louis Challis**

THE NAME Mordaunt Short is relatively unknown in Australia, for the product of this small English manufacturer has only recently reached the Australian market.

The Pageant Series II is the second largest speaker in their series, with a recommended retail price of \$698. The basic design of this system is conventional, consisting of a 280 mm diameter bass-mid driver and a 25 mm dome tweeter installed in a conventional bass reflex enclosure with a volume of 40.5 litres. This is a rather handy size, designed to suit most residential situations, and provides a reasonable compromise between low frequency bass response and good mid-frequency performance, with the capability of providing output extending up to 25 kHz.

### Design

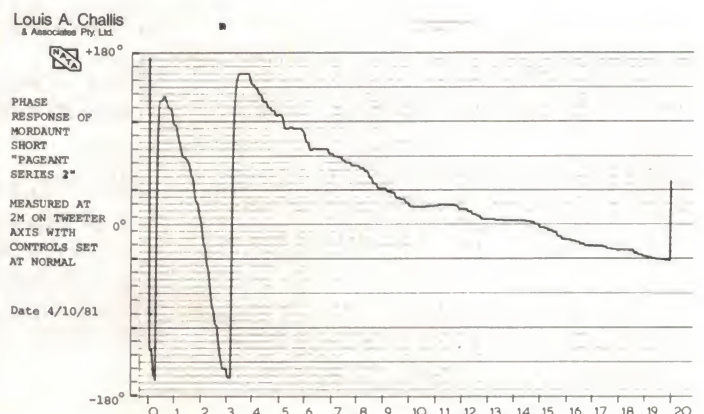
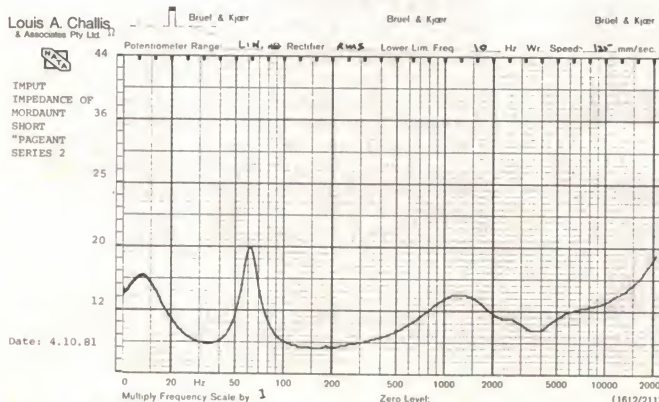
The configuration chosen sensibly locates the tweeter and bass/mid-range unit in a vertical line, with the DSB208 bass/mid-frequency transducer towards the bottom of the enclosure, the tweeter some 250 mm vertically above it, on the central axis, and the 37 mm venting port at the very top of the unit. This places the bass unit in a rather unsuitable position to optimise the reflection component from the floor, and for this reason the manufacturers recommend placing the speaker on a stand at least 400 mm above floor height in order to improve the bass response.

The DSB208 is a versatile speaker incorporating a ceramic magnet assembly and a long-throw voice coil with a linear suspension system, supplemented by a

compliant role surround, to achieve a reasonable low frequency performance at moderately high output sound pressure levels. This approach has obvious limitations, as a speaker designed to cover two decades of frequency must do so with some sort of compromise, which in this case is at the bottom end rather than at the top end.

The dome tweeter is a 25 mm diameter synthetic dome made of isophon unmodified KK10/8, which provides a reasonable compromise between absolute frequency linearity and natural frequency resonances.

The enclosure is manufactured from 15 mm thick, high density particle board, veneered internally and externally to provide a balanced stressing. The rear is sprayed in an artificial





flecked paint to minimise costs. The front panel utilises an effective artificial fabric with excellent flow resistance characteristics and is retained by plastic inserts on the front face of the cabinet.

The lower edge of the base of the cabinet features a satin-look brushed aluminium escutcheon plate. The rear incorporates a pair of spring-loaded terminals in a recessed wall for entraining bared wires, together with a DIN speaker socket and two slide switches to provide a nominal 3 dB cut for both the mid-range and high frequency range. This facility is indicated by a simple frequency curve, which forms part of the labelling on the rear of the cabinet itself. Whilst the cabinet is braced by internal wooden battens, it does exhibit a higher degree of mechanical resonance when struck by the fist than I would normally expect from a well-designed enclosure. This phenomenon does of course show up well in the decay response spectra curve, and more will be said about it later.

## On test

The objective testing of the enclosure provided a few surprises. The first relates to the frequency response measured at 2 m on axis, with the microphone positioned on the same level as the tweeter with the two switch controls set to normal. Under these conditions the interaction between the loading port and the bass driver provides some degree of interference, resulting in the output between 40 Hz and 150 Hz being typically 6 dB lower than that provided for the rest of the frequency response. Obviously by positioning the microphone in a different position this can be corrected for, but as this is our standard measurement position, we chose to stay with it in order to provide a consistent comparison.



Apart from the low frequency interaction phenomenon the frequency response can be described as being remarkably flat and in excellent agreement with the manufacturer's own curves (which are presented at 1 m reference).

At 30° off axis the frequency response is still good, extending to beyond 11 kHz, at which point the roll-off becomes sharp, as would normally be expected from this type of tweeter system. Activation of the mid and top-cut controls provides a small but sensible level change in the overall response, and unlike certain other American and European speakers in which such controls virtually wipe out either the mid-range or high frequency end of the spectrum, these controls again constitute a compromise between gross change in frequency response and what I believe is a more acceptable modest change.

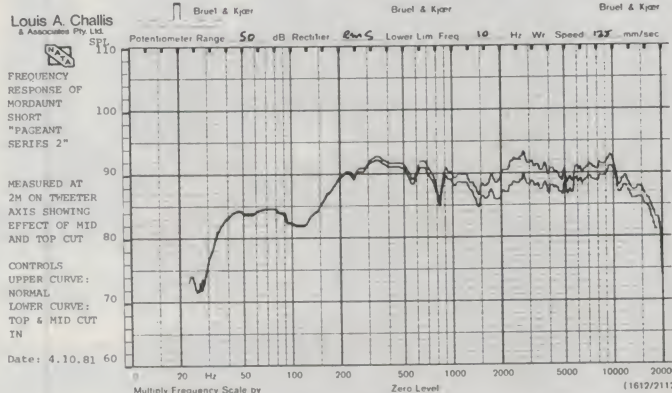
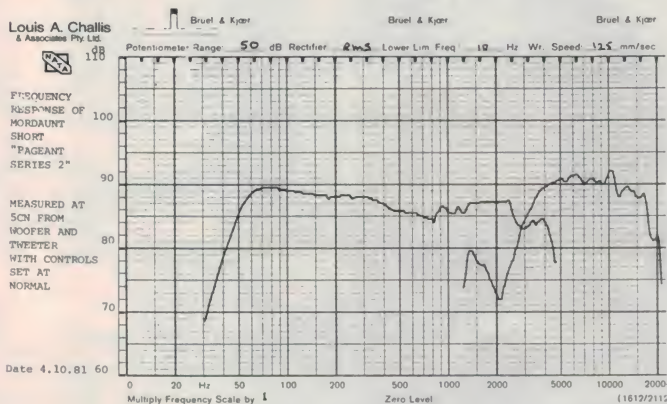
The frequency response measured at 5 cm from the woofer and tweeter respectively shows that the designers have achieved a fairly sensible and smooth response from each of the drivers which is, in general terms, better than that achieved by many more expensive speaker systems that we have recently tested.

The impedance curve is also good, featuring a modest, low value impedance peak of only 20 ohms at 62 Hz and a lowest value of impedance of 7.2 ohms at 170 Hz. This impedance curve is smooth enough to allow this speaker to be paralleled with any other normal 8 ohm speaker system without any likelihood of serious matching problems. The impedance curve is smoother than in most of the units in the same price range.

The phase response is a little unusual in that it exhibits a full 360° change of phase at the 3 kHz crossover, thereafter being relatively smooth, with less than 150° change over the operating range of the tweeter.

The distortion characteristics of the speaker are not a strong point and only fair, while the output is kept to less than 87 dB at 2 m (which corresponds to 93 dB at 1 m). The testing we would normally have performed for 100 Hz of 90 dB at 2 m (96 dB at 1 m) could not be performed because of the very high level of distortion produced by the bass/mid-range unit. We were forced to reduce our drive level down to 87 dB for the 100 Hz frequency, only at which point was the distortion level 4.1%. Fortunately the distortion levels at the standard test frequencies of 1 kHz and 6.3 kHz were quite acceptable, and one could deduce from this that the bass/mid-range unit is a much better mid-range than a bass unit.

The tone burst testing revealed a significant degree of ringing both at 1 kHz and at 6.3 kHz, and this was con-





# Name our E-I. And win a S--r

If you can fill in the gaps you're on your way to winning the prize.

And what a prize it is. The Star Video cassette library.

All the excitement of your favourite movies will be at your fingertips. Star Video library features new releases like Cabaret, Straw Dogs, Bilitis, The Story of O.

Classics like Intermezzo, Spellbound, Rebecca.

Children's greats like Treasure Island and Robin Hood. And educational cassettes presented by experts





r names.

# Video cassette library.

like Alan Seale, Dr. Wright, Charmaine Solomon. To win the Star Video cassette library you have to fill in the gaps in the name of this magazine.

There's a total of \$25,000 worth of prizes in the Name our Names contest. In Wheels and Two Wheels you could win a MiGi sports car valued at \$7,200.

In Revs and Modern Motor you could win a Kawasaki K175 trail-bike, Eurovox car stereo, Bob Jane mag wheels and tyres, Astraview sunroof and a Perfect Tune car cylinder head conversion valued at over \$2,000. In Modern Boating and Modern Fishing you could win a Haines Hunter runabout V133 outboard, 55 h.p. Tohatsu outboard motor and D.A.M. fishing tackle valued at \$5,290. In Outdoors and Overlander you could win a Jayco Jayfinch camper trailer valued at \$4,600.

In Australian Golf and Rugby League Week you could win Dunlop golf gear, a Sony video recorder and Star Video sports library valued at \$3,400.

The name of this magazine is:

E - I.

Read the conditions, fill in your entry form and mail it to Name our Names, Murray Publishers Pty. Ltd., 154 Clarence Street, Sydney. The first correct entry opened wins the Star Video cassette library.

Name \_\_\_\_\_

Address \_\_\_\_\_

Postcode \_\_\_\_\_ Telephone No: \_\_\_\_\_

Conditions of Entry: 1. Only entries received by the closing date will be accepted and proof of posting will not be considered as proof of entry. 2. The Judges' and company's decision is final and no correspondence will be entered into. 3. All entries remain the property of the Editor. 4. The winner will be notified by registered mail and the name published in the June issue of this magazine. 5. The prize is not redeemable in cash, nor transferable to a third party, except where the winner is under 16 years of age, when the prize in total shall be delivered to the care of a parent or guardian. 6. Each entry must be handwritten on an original coupon printed in this magazine except in those States where local laws prohibit this limitation in which case an original handwritten entry in the same format as the coupon on plain paper will be acceptable. 7. Employees, and their relatives of Murray Publishers Pty. Ltd., or their related companies or agencies are ineligible to enter. 8. Submission of an entry to this competition indicates acceptance of the above conditions, and no claim of a legal nature will be entertained as a result of such participation by any contestant. Closing date, April 30th, 1982. Permit No: TC81/1735.



firmed by the decay response spectra. The initial decay was fairly smooth with the exception of primary resonances in the 3 kHz, 6 kHz and 12 kHz regions. Significant second-order ringing is observable at these frequencies and four other frequencies, three of which are above the normal audible range of detection.

The speaker exhibits fairly modest sensitivity, requiring something in the vicinity of 5.5 watts of energy to produce the standard signal level. Based on this input power and the manufacturer's stated rating, it seems advisable that amplifiers with power ratings of at least 15 watts should be used with the speakers and that a peak power limit not exceeding 100 watts should be specified without separate fusing in the speaker leads.

## Subjectively

The subjective testing of this system was carried out by referencing it against two other well-known British speaker monitor systems, on a range of classical, rock, guitar, voice and orchestral music. The mid-range performance of the Pageant Series II system is

excellent, and with it comes a naturalness of spoken and singing voice which belies the cost of the system itself. By contrast, on much of the violin music and particularly on timpany I found the treble just a little more coloured than I would like in a good speaker system, and this is in good agreement with the visual analysis of the decay response spectrum.

This deficiency was of course overshadowed by the bass response, which is generally good at power levels of less than 5 watts, but with powers of greater than 5 watts and frequency components of below 100 Hz gives rise to significant and very audible distortion. On heavy rock the bass speaker output breaks up completely and can produce distasteful sounds unless one is prepared to turn down the amplifier level to compensate. The speakers do not protect themselves from excessive drive, so using a very high-powered amplifier with this speaker is definitely not a good idea.

The Pageant Series II is designed to produce an excellent to above average reproduction of choral works, monitoring of light music and associated speech reproduction, good to excellent repro-

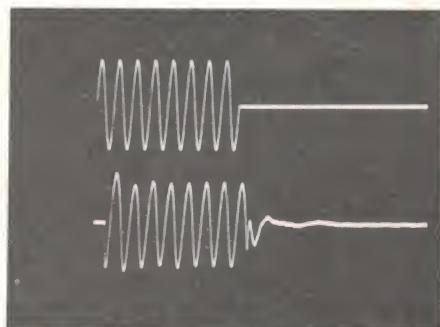
duction of classical music and fair to middling performance on rock music. If you are a high fidelity buff then the Mordaunt Short Pageant Series II is most probably just about your 'cup of tea'. If you are a hard rock fan or one of the younger generation who have a taste for what can only be described as 'heavy' music, then the Mordaunt Short Pageant Series II speakers are unlikely to meet your requirements.

## MORDAUNT-SHORT PAGEANT SERIES 2 LOUDSPEAKER SYSTEM

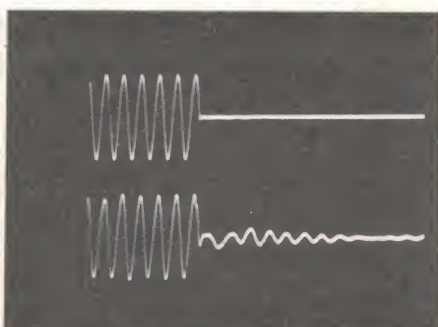
Dimensions:	533 mm high, 333 mm wide, 230 mm deep.
Weight:	9.6 kg
Price:	\$698
Manufacturer:	In the United Kingdom by Mordaunt Short Ltd, Hampshire
Distributor:	Concept Audio, 22 Wattle Rd, Brookvale NSW.

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.

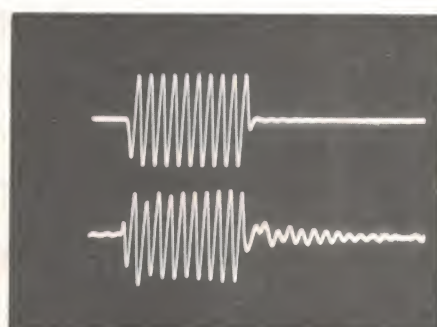
Tone burst response of Mordaunt-Short Pageant Series 2, serial no. 47612 (for 90 dB steady state SPL at 2 m on axis). Upper trace is electrical input; lower trace is loudspeaker output.



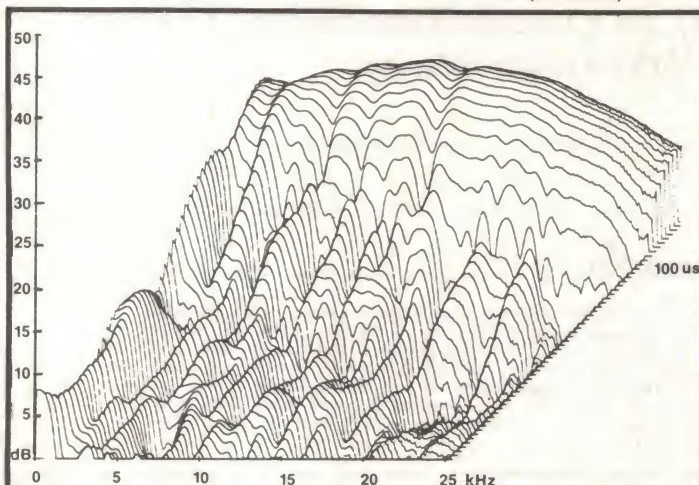
100 Hz (20 ms/div.)



1 kHz (2 ms/div.)



6.3 kHz (0.5 ms/div.)



## MEASURED PERFORMANCE OF MORDAUNT - SHORT "PAGEANT SERIES 2" SERIAL NO. 47612

<b>FREQUENCY RESPONSE:</b>	40Hz - 18kHz		
<b>CROSSOVER FREQUENCIES:</b>	3.5kHz		
<b>SENSITIVITY:</b>	(for 90dB average at 2m) 9.4 VRMS = 11 Watts (nominal into 8 )		
<b>HARMONIC DISTORTION:</b>	(for quoted sound pressure level @ 2m)		
	(87dB)	(90dB)	(90dB)
	100Hz	1kHz	6.3kHz
2nd	-28.8	-42.2	-52.2
3rd	-34.2	-42.5	-61.2
4th	-53.3	-53.2	-
5th	-47.2	-61.8	-
T.H.D.	4.1%	1.1%	0.26%
<b>INPUT IMPEDANCE:</b>	100Hz	8 Ω	
	1kHz	13.6 Ω	
	6.3kHz	12.0 Ω	
	Minimum at	170Hz	7.2 Ω





Electronics Today International is published by Murray Publishers Pty Ltd, 15 Boundary St, Rushcutters Bay NSW 2011. It is printed (in 1982) by Offset Alpine, cnr. Wetherill and Derby Sts, Silverwater NSW, and distributed by Gordon and Gotch.

Editor

**Roger Harrison VK2ZTB**

Technical Editor

**David Tilbrook VK2YMI**

Production Editor

**Jane Clarke B.A. (Hons)**

Editorial Staff

**William Fisher B.Sc. (Hons)**

**J.B. Scott B.Sc./B.E. (Hons)**

**VK2YBN**

**Jan Vernon B.A.**

Layout

**Bill Crump**

**Githa Pilbrow**

Typesetting

**Deborah Newman**

Reader Services

**Pam Lord**

Managing Editor

**Collyn Rivers**

Acoustical Consultants

**Louis Challis & Associates**

**Mail enquiries:** There is no charge for replies, but a foolscap-sized, stamped, addressed envelope must be enclosed. Queries relating to projects can only be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are other than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.

**Phone enquiries:** We can only answer readers' technical enquiries by telephone after 4.30 pm. In enquiring by telephone about back issues or photostats, please ask for the Subscriptions Department.

(02)268-9015

Editorial and Sales Office:

4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Ph: (02)268-9811; Tlx: 27243

Sales Manager: **Bob Taylor**

Sales Admin: **Pam Lord**

(address as above)

**Melbourne:** Virginia Salmon, 150 Lonsdale St, Melbourne Vic 3000. Ph: 662-1222; Tlx AA34543.

**Adelaide:** Admedia Group, 24 Kensington Rd, Rose Park SA 5067. Ph: 332-8144; Tlx AA82182.

**Brisbane:** Geoff Horne Agencies, 16 Bellbowrie Centre, Bellbowrie Qld 4070. Ph: 202-6813.

**Perth:** Aubrey Barker, 133 St Georges Terrace, Perth WA 6000. Ph: 322-3184; Tlx: AA93810

**New Zealand:** Frank Hargreaves, Circulation Marketing Manager, c/- ACP, 4th Floor, Sun Alliance House, 42-44 Shortland St, Auckland. Ph: (9)30311.

**United Kingdom:** Australian Consolidated Press, Ludgate House, 107 Fleet St, London EC4A 2AL. Ph: 353-1040; Tlx: 267163.

**Japan:** Genzo Uchida, Bancho Media Services, 15 Sanyei-cho, Shinjuku-Ku, Tokyo 160. Ph: 359-8866; Cable: Elbanchoro; Tlx: BMSINC J25472 Tokyo.

**USA:** Australian Consolidated Press, 21 East 40th Street (Floor 23), New York NY 10016. Phone: (212) 685-9570.

The publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

## ORDER FORM

I enclose \$ . . . . . for (tick appropriate box/es). All prices include postage.

Send orders to: ETI, 4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Phone: (02)33-4282.

☐

**Subscriptions**

\$23.30 per year within Australia

\$ . . . . .

\$36.60 overseas (surface mail)

\$ . . . . .

Airmail rates on application

**NAME (Please print)**

☐

**Back issues**

\$2.50, available from November 1978.

**ADDRESS** . . . . .

☐

**or photocopies**

\$2.50 per article per issue

Project No. . . . . Month . . . . . Year . . . . . \$ . . . . .

Project No. . . . . Month . . . . . Year . . . . . \$ . . . . .

Project No. . . . . Month . . . . . Year . . . . . \$ . . . . .

Project No. . . . . Month . . . . . Year . . . . . \$ . . . . .

Please attach a list if more than four required.

☐

**Binders**

No. . . . . @ \$6.10 in NSW

\$ . . . . .

No. . . . . @ \$7.50 in other states

\$ . . . . .

**POSTCODE** . . . . .



# MINI-MART

## Where readers can advertise — For Sale/Wanted/Swap/Join.

● We'll publish up to 24 words (maximum) totally free of charge for you, your club or your association. Copy must be with us by the 1st of the month preceding the month of issue. Please — please — print or type adverts clearly, otherwise it may not turn out as you intended! Every effort will be made to publish all adverts received; however, no responsibility for so doing is accepted or implied. Private adverts only will be accepted. We reserve the right to refuse adverts considered unsuitable.

● **Conditions:** Name and address plus phone number (if required) must be included within the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.

Send your advert to:

ETI Mini-Mart,  
4th Floor, 15 Boundary St,  
Rushcutters Bay NSW 2011.

### AUDIO

**THE RECORDING SOCIETY** of Australia, established 1964, invites you to join monthly demonstrations, lectures, live recordings etc. For information and syllabus write to Don Patrick, 36 Argyle St, Macleod Vic 3085. Phone (03)459-1717.

**KEYBOARD CASE ONLY** ex Hammond organ model X2 (new), black vinyl and chrome folding stand. Internal dimensions (case) 31" x 16" x 7". \$120. (03)25-2119.

**HI-FI MAGAZINES:** (120), last 2 years' 'Audio', 'Stereo Review', 'High Fidelity', 'Practical Hi-Fi', 'Hi-Fi for Pleasure', etc. \$45 or offer. (02)620-1203.

**THE TAPE CLUB** of AUSTRALIA welcomes new members. Enter a whole new world through your tape/cassette recorder. Full details: SAE to 7 Coleman Ave, Homebush, NSW 2140 or PO Box 118, Wellington, NSW 2820.

**PAIR HEATHKIT 'Cotswold' speakers**, spare bass driver, \$100. Playmaster valve tape adaptor, needs repair, Truvox deck, boxed, \$100. Proceeds R.P.A. Hospital. Dorsch (02)89-1638, Woolwich.

**FOR SALE:** ETI 740 FM tuner + AM tuner built in. Works beautifully, \$90. Ring S. Sidoti (02)660-5120 after 5.30 pm.

**DID YOU GET** a cassette recorder for Christmas? Then why not join a tape club? Full details from the Tape Club of Australia, 7 Coleman Ave, Homebush NSW 2140. Phone (02) 76-5330 after 6 pm.

**DO YOU OWN** a cassette recorder? Why not join a tape club? Full details from Boomerang Tape Recording, P.O. Box 118, Wellington, NSW 2820. Phone 738 after 6 pm.

### COMMUNICATIONS

**WANTED:** 'Command' or BC342 wartime receiver parts for student projects. Contact Rob Gurr VK5RG, Box 35, Daw Park SA 5041, or (08)276-4547.

**VLF RECEIVER**, fully portable. Covers audio frequencies, receives natural ionospheric sounds (whistlers, spherics), navigation beacons (OMEGA), etc. G. Neumann, Phys-chem. Dept., UNSW, Kensington 2033.

**CB COURIER Spartan 18 chan AM/SSB** with aerial, pwr supply, 15 m co-ax SWR meter and more, \$220. (02)427-6225.

**NOVICES UPGRADE:** Novice amateur radio group is conducting AOCF course by Ron Bircham, VK2DQ. Starting 3rd Sat Jan at WIC, St Leonards NSW. Ph John: (02)86-3364.

**AUSTRALIAN RADIO DX CLUB:** For shortwave, mediumwave, utility and amateur listeners. Big monthly bulletin sent to all members. Details from Box 260, Carnegie Vic 3163 for a stamp.

### MISCELLANEOUS

**SELL:** Weller temp. controlled soldering iron with transformers, 60 W, all working, \$30. 160 20k trimpots, \$10. 15 2500 uF 35 V caps, \$10. Ring (03)318-1271.

**TEXAS-55 CALCULATOR** with manuals, original condition, suitable tech. student, now surplus to requirements. A steal at \$35. (02)665-5794.

**WANTED:** August 1977 Electronics Today magazine. Reasonable condition. Also January 1979 Electronics Australia mag. Contact Chris Nixon, 7 Soames Pl, Bentley WA 6102.

**FOR SALE:** Sound effects, amplifiers, power supplies, test gear, 2-core cable, music colour, light chaser, auto transformer, Cannon connectors. Ronell, (02)331-3547.

**WANTED:** Kriesler/Phillips ultrasonic transmitters, also Kriesler television set with 59/3 chassis, both working or not. Swap 59/1 deflection board for 59/3. (02)645-3737 after 5 pm.

### COMPUTERS

**Z80 STARTER KIT**, hex keypad, EPROM programmer, 2K RAM, 2K monitor, S100 expansion, cassette interface, hex address and data display, Z80 CTC and PIO, \$250. (03)386-6156.

**FOR SALE:** ASR-33 printer, 110 baud, with interface to run off cassette port on TRS80/System 80. \$350 including spares and manuals. (02)981-4762.

**WANTED:** SWTP MPA or MPA-2 6800 CPU. Bare board or assembled. Contact R. Steedman, (05)156-8291, or write to P.O. Box 98, Bairnsdale Vic. 3875.

**COPYRIGHT:** The contents of Electronics Today International and associated publications is fully protected by the Commonwealth Copyright Act (1968).

Copyright extends to all written material, photographs, drawings, circuit diagrams and printed circuit boards. Although any form of reproduction is a breach of copyright, we are not concerned about individuals constructing projects for their own private use, nor by pop groups (for example) constructing one or more items for use in connection with their performances.

Commercial organisations should note that no project or part project described in Electronics Today International or associated publications may be offered for sale, or sold, in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publishers, Murray Publishers Pty Ltd, or from the copyright holders.

**LIABILITY:** Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number. Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any components parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid. The Publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

**FORTH Interest Group** meets first Friday each month. Contact FIG P.O. Box 103, Camberwell Vic. 3124. (03)29-2600.

**SELL EA VDU**, includes 124 VA transformer, cassette interface and professional-style keyboard. Working order, suit Miniscamp, etc. \$140. (050)27-4701 (ah).

**OHIO SUPERBOARD II**, 8K RAM plus high quality video unit with inbuilt power-supply, BWD 421 CRO dual trace, going cheap. Phone Ronn, (02)587-6168.

**HALL-EFFECT KEYBOARD**, unused, fully ASCII encoded, all keys for word processing, \$130. In shop \$200 plus. 230 Wheeler Cres, Wannlassa ACT. 31-5829.

**APPLE II compatible 48K computer system** with disk drive, CTV/monitor, game paddles and DOS 3.3. \$2450 ono. (02)724-4548 after 7pm.

**SELL:** ZX-80, 1K, old ROM, ps, games and companion bks, display hold prog., 9 newsletters, cost \$360, sell \$225. Geoff Black, 27 Killarney Cres, Capalaba Qld 4157.

**OSI SUPERBOARD II** complete with 8K RAM, power supply and manuals, ready to operate, \$290. Contact Dane Howe, (03)350-1646 (ah).

**TELETYPE ASR33**, excellent condition, tape reader and punch, 20 mA interface, maintenance manuals, \$300. Phone (03)29-2600.

**MICROLINE 80:** Brand new, in carton, \$650. Paul Wilson, (03)758-1554.

**FOR SALE:** 16K S-100 4 MHZ static RAM. Call-fornia Computer Systems model 2016 with Bank Select Manual, etc. New and experienced guaranteed OK. Retail \$330, sell \$165. Phone (069)53-2848. John Watson. P.O. Box 108, Leeton NSW 2705.

**TRS-80, MOD 1, LEV II** with LNW exp. I/F, 2 disk drives, Axiom 801 printer, large amount software, manuals, spare drive. Details Len Scotney (02)726-2163. \$2500.

**Z80 STARTER KIT USERS:** New 2K monitor in EPROM includes arithmetic routines, CTC controller, random number generator, reads/writes data 25 times faster. Write for details: U. Knop, 13 Want St, Parkes NSW 2870. (068)62-3359 (ah).

**EPROM PROGRAMMING 2716, 2708, 2516 5 V EPROMS.** From KC cassette \$5, from listing \$15 for 2K bytes. Chip not included, cassette's returned. U. Knop, 13 Want St, Parkes NSW 2870. (068)62-3359 (ah).

**SELL:** S100-Z80 CPU card, DG640 VDU, 16K RAM, power supply and motherboard, all operating. Phone George Poropat, Mulgrave Vic. (03)560-4078.

**HEATH/ZENITH H8 computer** with H17 disk drives, CPM/HDOS operating systems, BASIC, etc. Serial printer port for word processing. \$1500 (03)233-6739 (ah).



16K SYSTEM 80 MKII computer. Video monitor, over \$190 in programs including EDTASM plus, covers, excellent condition, \$800. Freight free. Ph: Clive (042)96-3381.

WANTED: Info on CDC's 9433 disk drives, or near type. From CDC 516, Honeywell 110 computers. Will pay. Martin, 8 Walker Pl. Church Pt NSW 2105. (02)99-2917.

SELL: Power supply, 240 Vac-12 V 2 amp, 5 V 1 amp. dc on aluminium chassis, \$34. Mark Sully, 61 Newman St, Niddrie Vic. 3042. (03)379-2879.

FOR SALE: Memorex 1280 computer terminal-printer-digital cassette, RS232 compatible. \$390. Anthony (02)674-2707.

SELL: SHARP PC1211 pocket computer with cassette interface. Identical to Tandy pocket TRS-80. As new, \$180. Colin, Ursula College, ANU, Canberra 2600. (062)49-2460 during working hrs.

BIGBOARD CP/M system, Z-80, 64 KB, fully optioned Ferguson board, Shugart 800 drive, software, professional 3-drive cabinet & P/S, keyboard & monitor, documentation, \$2450 or offers. (02)449-5885 ah.

WANTED: Back issues 1-12 (Jan-Dec 1980) of 80-Microcomputing magazine. Tom Milenkovic, Sydney (02)217-2303.

8" SHUGART 800 disk drives (2), \$390 ea. Teletype model 40 keyboard display terminal, \$760. Diablo daisywheel serial printer, \$1900. All excellent condition with documentation. (02) 449-5885 (ah).

APPLE II PLUS, 48K disk, VDU, software, \$2100 ono. Brian Walsh, Tocal College, Pater-son 2421. Phone (ah) (049)30-1148.

MICROTEK MT32.6, \$150.00. Upgrade from 16K to 48K. Memory chips included ready to run, just connect to your TRS-80 16K. The parallel printer port enables you to run most printers. A. Tito, 207 Lauren Street, Urangan Qld. 4658. (071)28-9527.

TANDY QUICK PRINTER II. 120 LPM upper/lower case on 2 3/8" aluminised paper, as new, and four rolls of paper included. Interface to suit System-80 included. \$200 the lot. A. Tito, 207 Lauren Street, Urangan Qld. 4658. (071) 28-9527.

FOR SALE: CHIPOS microcomputer, as in EA June, July '79. Uses 6802, slight modifications, \$100. Ring S. Sidoti (02)660-5120 after 5.30 pm.

SELL: 32K Sorcerer computer, Base-2 printer, National Monitor/TV, Development Pac, extensive software and documentation. As new. Retail \$2500+, sell \$1950. B. Blair, 3 Lee St, Noble Park Vic.

APPLE TWO PLUS, 48K RAM, disk drive, colour monitor and software, \$2600 ono. (03)873-3820, after 7 pm, ask for Terry. 29 Blanche Drive, Vermont Melb.

16K SUPER 80: \$400 ono, complete with attractive case, all manuals, BASIC tape. Cheaper than parts cost. Phone Michael Wise, bh (02)662-3789, ah (02)51-2335.

32K SORCERER, new condition, including serial data cable, books, \$1050. Sorcerer development pac, books, \$95. G. Dawson, Braleys Lane, Glen Innes NSW. (067)32-2082.

FOR SALE: TRS-80 LIE graphics package, Gunslinger Battlezone twice, Rantan, plus try winning using Lotto Analysis, \$6 per cassette. Geoff Egel, 18 Sturt St, Loxton 5333.

'12 IN 1' CIP-Debug 3 utility. 'Clear' screen, Step-Trace, auto in. no., call Jn, view, bell supp. etc. All-key control. Interface any monitor. 8K, 16K. \$15. Jankowski, Otaio RD1 Timaru, N.Z.

SYSTEM 80 OWNER would like to exchange programs. Please send list of programs to Mark Fairbairn, 8 Shelley St, Spring Gully, Bendigo Vic. 3550. (42-4450).

WANTED: Compucolor II with or without additional disk drive. Phone W. Woods, (02) 230-5279 (bus), (02)84-6764 (ah).

TO SWAP: System 80/TRS-80 programs. Send SAE for list of software to D. Brighton, Franklin Rd, Huonville, Tasmania 7109.

SELL: DREAM 6800 with PSU, plenty documentation, sockets throughout, software cassettes, no bugs, \$160. Contact Gerald, 34 Margot St, Chadstone 3148. (03)277-4870 ah.

THE INAUGURAL MEETING of the Brisbane Super 80 users' group will be held on Wednesday 10th February 1982 at 7 pm in room 21, first floor, Trades Hall, Wickham Terrace, City — ALL WELCOME.

SN74259N 8-BIT addressable latch, qty 750, at \$8 per 10. F9334 8-bit addressable latch, qty 1925, at \$8 per 10, plus P+P. Phone (03) 570-6620. (John).

SALE: 160 new 3M 50-way straight wire wrap headers, type 3433-4005. Only \$10 each. E. Crockett, 32 Anne Ave, Seven Hills NSW. (02)622-9614.

FOR SALE: TI-59 programmable calculator, printer, extra software. Retail \$750, asking \$450. Ultra-powerful number cruncher. Phone Michael Glasson, (089)89-9211.

# A picture of the 1981 4WD of the Year.



You take the 5 best four wheel drive vehicles for 1981. And 12 of the best drivers.

Then you go bush.

And find the 1981 4WD of the Year.

The result is in Overlander, February. Twenty four pages of road tests, off road tests, suspension tests, performance tests.

The five finalists:

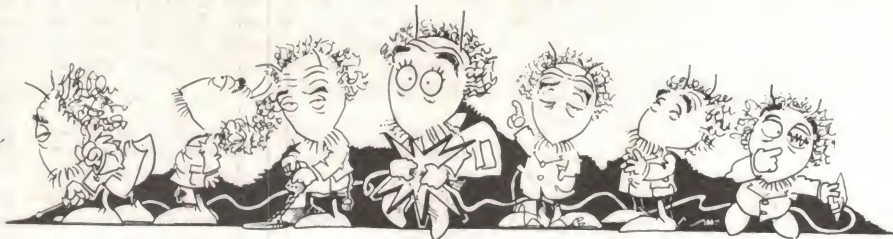
MITSUBISHI EXPRESS  
SUZUKI SIERRA  
HOLDEN JACKAROO  
TOYOTA SERIES 60  
JEEP CHEROKEE.

The winner: you'll have to read Overlander, February.

## overlander



# ORCS



AN ASSOCIATE of ours purchased a semi-detached house in a trendy inner-city suburb some years ago. In the course of renovations, he struck up relations with his semi-detached neighbour. Naturally enough, the neighbour had a hi-fi system — of sorts — and was introduced to the delights of ETI readership. On occasion, the semi-detached neighbour was wont to turn up the 'wick' on his sound system. This occasioned some discomfort in our associate's house, until he hit upon a remedy. Figuring that the sound system next door was of some vintage, and probably unprotected against the ravages of electromagnetic interference, our associate tried an experiment. When the sound system next door began to sound like it was no longer next door, he retreated to his ham shack and fired up on 14 MHz. At full power. All 400 watts of it.

The ham antenna, being but a scant

few metres from the semi-detached sound system, had little difficulty in overloading the sound system with RF energy. The sound system protested — delivering plenty of the protest via the loudspeakers, and the occasional smoke signals. The semi-detached neighbour, not being familiar with such things, assumed his sound system had developed a fault and promptly turned it off. Naturally, he looked to his electronically-inclined neighbour for assistance. Our associate obliged and requested a demonstration of the fault. But... miraculously, it had disappeared! Hmm, perhaps it might be best if you keep the volume down, our associate advised.

The semi-detached neighbour heeded the advice... for a while. When next the semi-detached sound system reached an unbearable crescendo our associate decided it was time for a lengthy 'CQ DX' call on the ham rig.

The semi-detached sound system mysteriously quieted.

The 'arrangement' worked well — until the semi-detached neighbour decided an upgrade was in order and built a pair of Series 4000 loudspeakers. When the Series 5000 equipment appeared in ETI last year, he decided a complete upgrade was called for. Semi-detached neighbour was proud of his achievement... and the volume the system would deliver.

This is where the 'arrangement' broke down. Our associate is now muttering dark things about David Tilbrook's Series 5000 design — it's immune to any sort of brutal RF overload he can devise!

Does anyone have deaf parents interested in inner-city living, close to all amenities, in a trendy, renovated house, nothing to spend?





**SONY**  
THE ONE AND ONLY

## Supernatural Sound.

Walkman is guaranteed worldwide for 90 days  
under Sony's International Warranty System



Enter the state of higher fidelity with the new Walkman 2 stereo player, the world's smallest Hi-Fi. It's a sensational way to listen to music on cassettes and raise your awareness of sound. Walkman is so light it practically feels weightless. So small it's hardly bigger than

the plastic case that cassettes come in. And so personal, with headphones that weigh next to nothing, that Hi-Fi has never been more intimate. The new Sony Walkman. It can make your experience of sound infinitely wondrous.

*The World's Smallest Hi-Fi*  
**WALKMAN**

SON 0114





## THE IDEA BEHIND OUR RADIO CASSETTE RECORDERS.

The stereo headphone represents perfect stereo reproduction.

As well as receiving sound through your ears, you appear to receive sound from above your head.

This added dimension in sound is stereo.

Of course, anyone can get this sound from any good stereo radio cassette recorder if they listen through stereo headphones.

But, at JVC, we realised it was impractical to wear stereo headphones all the time.

So we invented a new kind of sound system just for our stereo radio cassette recorders.

The Biphonic System.

This exclusive system offers 3-dimensional sound effects, so you enjoy true stereo reproduction without headphones.

If you'd like to know more about the many innovations JVC has brought to the stereo radio cassette recorder, write to us for a brochure, or call in to any JVC dealer.

Then you'll see why JVC equipment is recognised as The State of the Art.

